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ABSTRACT

Data primarily from Australia's Youth in Transition Survey were analyzed to explain differences in the schooling decisions of individuals born in 1961 versus 1970. The main measured factors affecting individuals' schooling decisions were as follows: ability; school type; and family background. Participation in school was positively associated with individual ability, enrollment at a nongovernment school, and having parents with high educational attainment. The main factors that have contributed to the change in educational attainment of the 1970 cohort compared to the 1961 cohort were as follows: individual ability; parents' educational attainment; family size; and attendance at Catholic and other independent schools. Over the decade studied, male and female schooling increased at similar rates, with the mean female schooling level increasing only slightly faster than the mean male level of schooling. The analysis indicated that labor market reforms focusing on females per se are not likely to have a major impact on females' schooling decisions. Information on the following items is appended: the ordered probit model of participation in education; decomposition analysis of changes in educational attainment over time; the study data and variables; decomposition of schooling attainments based on logit models; and the return to education and school continuation decisions. (Contains 17 tables and 46 references.) (MN)

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Research Report Number 25

Educational Attainment in Australia:
A Cohort Analysis

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Research Report Number 25

EDUCATIONAL ATTAINMENT IN AUSTRALIA: A COHORT ANALYSIS

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EXECUTIVE SUMMARY

The decision to invest in education is influenced by a large number of economic, social, family, personal and institutional factors. Many of these changed during the 1960s, 1970s and 1980s. Several of the more important of these changes are not expected to have impacted equally on the schooling decisions of males and females. This expectation appears to be borne out by the aggregate school participation rate data. Over the four decades from 1960 to 1999, there was an increase in the male school participation rate of 24 percentage points and a 32 percentage point increase for females. The gender school participation rate differential in favour of males narrowed progressively, particularly during the 1970s, to the point in 1985 where the participation rates of males and females were the same. Since 1986 the school participation rate of females has exceeded that of males. There was also a significant increase over the period in female participation in higher education relative to that of males.

Using the *Youth in Transition Survey*, this paper attempts to explain differences in the schooling decision of two cohorts, namely individuals born in 1961 and 1970. The aims are to establish whether the way in which education decisions are made differ across cohorts, and to assess whether any such differences can be related to the institutional reforms that occurred over the 1960 to 1980 period. The study emphasises differences in schooling decisions across gender.

The main measured factors that affect an individual's schooling decision at a point in time are ability, school type and family background. Participation in school is positively associated with individual ability, enrolment at a non-government school and having parents with high educational attainment. These findings are consistent with previous Australian and overseas research. Attention is in particular drawn to the dominant role played by ability in these and related analyses. Miller, Mulvey and Martin (2001), for example, use an alternative research methodology to show that the greater part of the variance in educational attainments is due to genetic endowments, thus downplaying to some extent the role of family background, which is generally considered as an indicator of the inequality of schooling opportunity.

The study shows the main factors that have contributed to the change in educational attainment of the younger (1970) cohort compared to the older (1961) cohort are individual ability, the parents' educational attainment, family size and attendance at Catholic and other Independent schools. The approach taken in this study permits the relative importance of each of these influences on the change in educational attainment over time to be established. Reasons for the links between each influence and educational attainment are discussed, and implications drawn out. For example, the positive value for the parents' educational attainments reflects the growth in the education of parents over time. It also shows that the inheritance of attributes such as education will have some impact on the individual's success in later life. The positive values of the explained component for the school types variables follow the growth in retention rates for individuals in non-government schools over the decade.

With regard to differences in educational attainment across gender, the analyses show that male and female schooling have increased at similar rates over the decade under review, with the mean female schooling level increasing only slightly faster than the mean male level of schooling. The slight increase in female schooling relative to that of

males is due almost entirely to differential rates of change in the characteristics of males and females, including individual ability, parent's education, family size, wealth and attendance at Catholic schools. In comparison, changes in the estimated coefficients play a minor role in explaining the gender difference in schooling. Such changes, which reflect changes in the way measured variables are linked to educational attainment, are generally attributed to the role of external factors, such as social and labour market reforms. Accordingly, the results suggest that major changes in the labour market with a focus on females per se during the 1970s and 1980s, specifically the Equal Pay for Equal Work decision of 1969, the Equal Pay for Work of Equal Value decision of 1972 and the Sex Discrimination Act of 1984, have had little impact on the difference in schooling between males and females. This may be because female schooling decisions are made on the basis of within-gender comparison of the advantages associated with higher levels of education.

The findings reported in this study indicate that, in terms of cohort analysis, further attention in research needs to be devoted to the time periods covered, so that the cohort analysis can overlap the much wider period covered in typical cross-sectional studies such as Le and Miller (2001). Attention also needs to be devoted to the role of the father's occupational status and the educational attainments of both the mother and father. The role of these dimensions of family background in affecting decisions other than the school leaving decision should also be investigated. Included here are the associations between family background and the type of school attended. Such analysis would provide understanding of some of the important changes documented in this study and referred to simply as 'changes in means'.

The analyses show that labour market reforms that have a focus on females per se are not likely to have a major impact on female schooling decisions. However, any increases in the income and other advantages associated with higher education among females may have an influence. It is also evident that school type has a considerable bearing on school leaving decisions. The reasons for this are in need of examination. Moreover, the importance of ability in comparison to family background factors in contributing to differences in educational attainment is consistent with other research in this area using different data sets and analytical techniques (e.g., Miller, Mulvey & Martin 2001). In the context of the decompositions advanced in this study, as changes in the ability variable are generally considered to be outside the scope of education policy, changes in educational attainment might arise only through changes in the way individuals of different levels of ability make decisions. To this end the curriculum in, or advantages offered by, the various levels of education may need to be the focus in order to achieve the change in coefficients that have been shown by the decomposition analyses as being needed in order for there to be a major impact on educational attainments.

Educational Attainment in Australia: A Cohort Analysis

1. INTRODUCTION

The 1960s, 1970s and 1980s were periods of major change in Australia. The voting in of the Labor Government in 1972, on the slogan 'It's Time', is illustrative of the mood for general social reform during this era. Important laws such as the Family Law Act of 1975, the Sex Discrimination Act of 1984 and the Affirmative Action (Equal Employment Opportunity for Women) Act of 1986 reveal that the impetus for social reform resulted in significant policy change. Similarly, the Equal Pay for Equal Work (1969) and Equal Pay for Work of Equal Value (1972) decisions had major impacts on the wage distribution, with the female rate of pay increasing considerably, both absolutely and relatively. According to Gregory and Duncan (1981), the female award rates as a percentage of those of males increased from 72 per cent in 1969 to 92 per cent in 1976. Over the same time period, female earnings as a percentage of those of males rose from 58 per cent to 77 per cent.

This period was also one of substantial reform and change in the schools sector. The curriculum was restructured across the various years of study, and methods of assessment altered (see, for example, Commonwealth Department of Education 1977). School participation rates increased markedly. The changes that took place in the schools sector and in society in general did not have a neutral impact on the schooling behaviour of males and females. Whereas more males than females participated in secondary and higher education at the commencement of this period, by 1976 the relative position of males and females in school participation rates had been reversed. At least some part of these changes in the schools sector may be linked to the changes in the labour market that occurred at this time.

The changes in school participation over the 1960s, 1970s and 1980s are important to understand because of the role educational attainment plays in determining a person's future success. The level of education appears to play a significant role in the determination of whether a person is employed or unemployed (e.g., Le & Miller 2000). It also appears to be closely related to the earnings of the employed (Borland 1996; Preston 1997) as well as their occupational attainment (Kidd & Meng 1997).

In an attempt to develop understanding of the determinants of educational attainment, this paper provides an analysis of the schooling decisions of two cohorts, namely individuals born in 1961 and 1970. These individuals will have made their school leaving decisions in the mid-to-late 1970s and mid-to-late 1980s—the key periods of social and economic change highlighted above. The aims are to establish whether the way in which education decisions are made differs across cohorts, and to assess whether any such differences can be related to the institutional reforms that occurred at the time. To facilitate this, the study emphasises differences in the ways male and female school decisions are made. The reason for this is that the most important of the institutional reforms that occurred are expected to affect male and female schooling decisions in different ways. While previous studies have examined both cohort and gender effects using the same data as employed in the current analysis (e.g., Williams, Long, Carpenter & Hayden 1993a; Long, Carpenter & Hayden 1999; Marks, Fleming, Long & McMillan 2000), the distinguishing feature of the current study is the more rigorous framework in

which the analyses are conducted. This framework allows changes to be assessed as significant in a statistical sense, and permits an encompassing summary of the origins of the changes over time in educational attainment, both for males and females separately, and relative to each other. The study reviews the evidence on the related measures of years of schooling completed, which is labeled educational attainment,[1] and completion of specific levels of education, which is generally termed a participation decision (e.g., participation in year 12).

The structure of the paper is as follows. Section 2 presents some basic data on school enrolments in Australia over the post-war period. Section 3 reviews models of educational attainment and school participation. Section 4 discusses the methodology that can be used in analyses of educational attainment or school participation that have a focus on cohort effects. The empirical results are presented in Sections 5 and 6. A conclusion is presented in Section 7.

2. A STATISTICAL PORTRAIT[2]

There have been significant increases in both male and female participation in secondary and higher education in Australia over the past four decades. Figure 1 reveals the broad trends in school participation rates over this period for 15-19 year olds.

The data in Figure 1 show that the school participation rate of all 15-19 year olds has increased steadily since 1960. For example, in 1960 22 per cent of 15-19 year olds were still in school. The figures for 1970, 1980 and 1990 are 34 per cent, 35 per cent and 44 per cent, respectively. A comparison between 15-19 year old males and females shows that during the 1960s the participation rate of females was below that of males. But by the late 1970s, the female participation rate exceeded the male participation rate. Figures for specific years can help illustrate this point. Hence, in 1965 the participation rates of males and females were 30 per cent and 25 per cent, respectively. By 1978, these participation rates had increased to 37 per cent and 38 per cent, respectively. Over the four decades covered in Figure 1, there was an increase in the male school participation rate of 24 percentage points and a 32 percentage point increase for females.

The changes in school participation rates described above carry over to the higher education sector. Figure 2 presents data on higher education enrolments as a percentage of the population of 15-64 year olds.[3]

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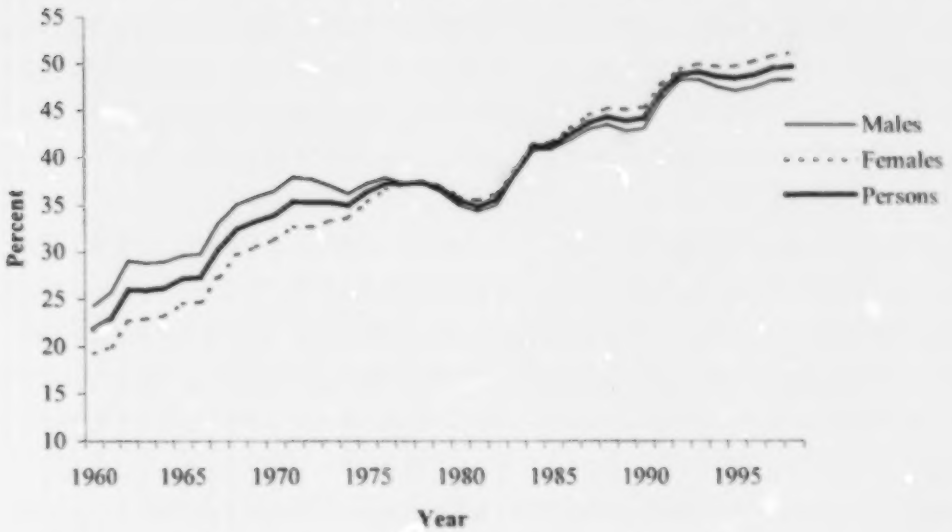
1 This terminology has been used in a number of studies (see, for example, Graetz 1990; Maglen 1991).

2 This section draws upon Le and Miller (2001).

3 There are many ways of presenting these data. The approach adopted is based on Table A.6 in Dawkins (1987).

Figure 1
School Participation Rates, 15-19 Year Olds 1960-1999

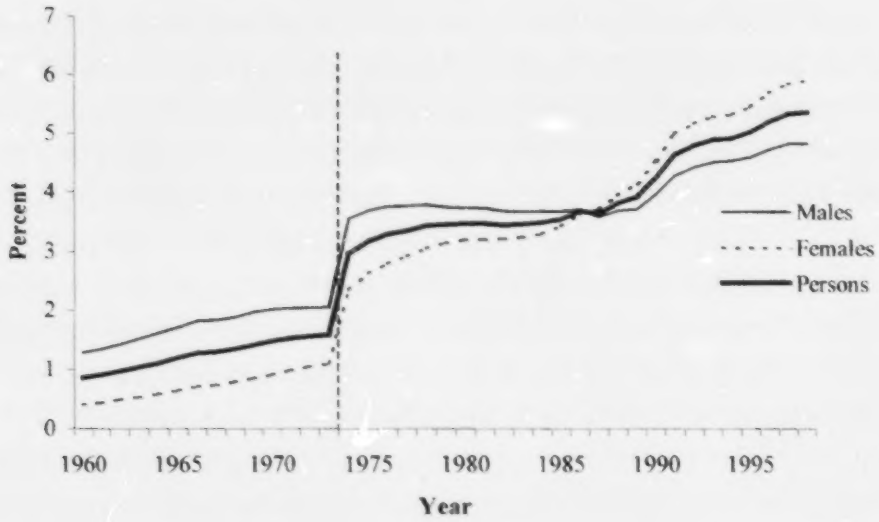


Note: The participation rate is expressed as the number of students aged 15-19 years of a particular sex as a percentage of the estimated population aged 15-19 years of the same sex.
1960-1971 participation rates were computed for individuals grouped as '15-19 years and over'.
1972-1999 participation rates were computed for individuals grouped as '15-19 years'.

Sources: 1960-1971 data were obtained from Australian Bureau of Statistics, *Yearbook, Australia*, Catalogue no. 1301.0.
1972-1986 data were obtained from Department of Employment, Education and Training (1993), *Retention and Participation in Australian Schools 1967-1992*, Australian Government Publishing Service, Canberra.
1987-1999 data were obtained from Australian Bureau of Statistics, *Schools, Australia*, Catalogue no. 4221.0.

A number of features can be noted from Figure 2. First, participation in higher education for all 15-19 year olds increased steadily over the four decades covered in the analysis. By way of illustration, the participation rates in 1960, 1970, 1980, 1990 and 1999 were 0.9 per cent, one per cent, three per cent, four per cent and five per cent, respectively. Second, there was a significant increase over the period in female participation in higher education relative to that of males. Viewed another way, the gender participation rate differential in favour of males narrowed progressively, particularly during the 1970s, to the point in 1987 where the participation rates of males and females were the same. Since 1987 the higher education participation rate of females has exceeded that of males. For example, the participation rates of males and females in 1960 were one per cent and 0.4 per cent, respectively. In 1973, two per cent of males and one per cent of females attended universities. In 1987 both males and females had a higher education participation rate of around four per cent. By 1999 the participation rate in higher education for females had increased to six per cent while that for males had grown to only five per cent.

Figure 2
Higher Education Participation Rates, All Students 1960-1999



Note: The participation rate is expressed as the total number of students of a particular sex enrolled in higher education as a percentage of the estimated population aged 15-64 years of the same sex. Figures for 1960 to 1973 are for universities only. Figures for 1974 to 1989 include universities and colleges of advanced education. Figures for 1990 to 1999 are for all higher education institutions funded by the Commonwealth. The vertical dashed line indicates a major break in the data.

Source: Authors' calculations based on raw data obtained from Department of Employment, Education and Training (1988), *Selected Higher Education Statistics*, Commonwealth Tertiary Education Commission, Canberra; Department of Education, Training and Youth Affairs (1998), *Higher Education Students Time Series Tables, Australia*, AGPS, Canberra; and Department of Education, Training and Youth Affairs (1999), *Selected Higher Education Statistics*, AGPS, Canberra.

A number of Australian studies have examined the gender differences in educational attainment that are a prominent feature of the trends in educational participation discussed above. These studies have investigated the roles of both economic and social factors. They have used a variety of data sets and methodologies ranging from tabular analyses to regression models. There are two main ways in which the gender differences in educational attainment can be modelled. Under the first approach, a gender term is included in an education model estimated on data pooled across males and females. This approach is used to enable researchers to assess the difference in the mean educational attainments of males and females, when other major influences on educational outcomes, such as family background, school type and ability, are taken into account. The alternative approach is to estimate an education model separately for males and females, and to use the estimates to partition the differences in the mean educational attainments of males and females into components due to differences in the marginal impacts of the independent factors on gender-specific educational attainment, and due to differences in the mean values of the determinants of educational attainment included in the model. There is an added advantage to this approach, as it permits assessment of whether any

given factor (e.g., family background, school type, ability etc) has a stronger or weaker influence on educational outcomes for males than for females. Such assessment is of interest for a variety of reasons. For example, a stronger impact of family background factors in the schooling outcome of males than of females may be indicative of family preference over the educational attainments of sons and daughters. In the review that follows, findings from both approaches will be discussed.

Studies which have used the first framework to examine differences in educational attainment across gender include Carpenter and Fleishman (1987), Williams and Carpenter (1990), Williams et al. (1993a, 1993b), Long, Carpenter and Hayden (1995), Long et al. (1999) and Marks et al. (2000). These studies examine the determinants of a range of educational decisions, from early school leaving to higher education graduation rates as well as participation in a TAFE course, apprenticeship or traineeship and in any form of post-school education and training. The estimating equations used are quite comprehensive. While there are some differences across studies, most analyses relate educational attainment to variables for individual ability, family background, school types, geographical location and schooling aspirations. Williams and Carpenter (1990), Williams et al. (1993a), Long et al. (1999) and Marks et al. (2000) for example, used the *Youth in Transition Survey*[4] to examine the probabilities of students completing year 12. Both ordinary least squares and logistic procedures were used. Williams and Carpenter (1990) found that 17 to 23 year old males from the 1961 cohort were more likely to complete year 12 than females from the same group. In contrast, Williams et al. (1993a) and Long et al. (1995) reported that 19 year old females from the 1961, 1965 and 1970 cohorts had higher completion rates than males, though the gender difference was relatively small. Long et al. (1995) also showed that the year 12 completion rate for 19 year old females from the 1975 cohort is much higher than that for males. In addition to the 1961, 1965, 1970 and 1975 cohorts, Marks et al. (2000) examined the year 12 completion rate for those who were year nine students in 1995.[5] They reported that female students who were in year nine in 1995 were more likely to complete year 12 than male students from the same cohort. A similar result is reported by Marks et al. (2000) for 19 year old female students from the 1975 cohort.

Carpenter and Fleishman (1987), Williams and, Carpenter (1990), Williams et al. (1993b), Long et al. (1999) and Marks et al. (2000) examine entry into higher education for males and females. Carpenter and Fleishman (1987) used survey data on year 12 students in Queensland while Williams et al. (1993b), Long et al. (1999) and Marks et al. (2000) used the *Youth in Transition Survey*. Ordinary least squares and logistic procedures were used. Gender differences in the educational transition rates were expected for a variety of reasons. One of the main reasons is that gender reflects opportunities provided by the social and labour market structures. There are social norms about appropriate roles for women regarding family responsibilities, child bearing and participation in the workforce which may limit their opportunities to participate in higher education. There are also parental aspirations towards the educational attainments of

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[4] The *Youth in Transition Survey* program comprises samples of people born in 1961, 1965, 1970 and 1975. Each cohort has been contacted a number of times. The data collected were primarily concerned with participation in education and the labour force, and with transitions within and between education and work.

[5] The data used are from the *Longitudinal Surveys of Australian Youth (Y95)* cohort which comprises over 13,000 students who were in year nine in 1995.

their children which have been emphasised in the Australian literature in Birrell's (1987) research into the educational achievements of non-English speaking background students. Moreover, females may be less likely to participate in higher education than males because higher education may not provide significant occupational advantage to them. If the gender difference in higher education participation rates is due to these factors, more females will participate in higher education over time as a result of changing societal attitudes on the role of females in the workforce, government policy that aims to encourage female participation in higher education, and labour market reforms that facilitate female participation (e.g., provision of child care) and progression (e.g., Affirmative Action Act of 1986) in the workforce.

Despite these clear expectations on the gender difference in higher education participation rates, and on how this might change over time, conflicting results across cohorts are reported in the empirical research. Williams and Carpenter (1990), for example, reported that 16 year old males from the 1965 cohort and 17 to 23 year old males from the 1961 cohort were less likely to enter into higher education than female students from the same cohorts. Focusing on the 19 year old age group, Williams et al. (1993b) and Long et al. (1999) showed that females who had completed year 12 from the 1961, 1965 and 1970 cohorts were less likely to enter into higher education than males.[6] Similar results were reported for 22 year old females from the 1961 and 1965 cohorts (Williams et al. 1993b). For the cohort of 19 year olds as a whole, Long et al. (1995) showed that the participation rates of females in tertiary studies in the 1961, 1965 and 1970 cohorts were lower than those for males. However, among those who were born in 1975, 19 year old females were more likely to enter into higher education. Marks et al. (2000) showed that gender differences in higher education participation are more important for younger cohorts (defined as those born in 1975 and those who were in year nine in 1995) compared to older cohorts (defined as those born in 1961, 1965 and 1970). For example, 19 year old females from the 1975 cohort and those who were in year nine in 1995, have participation rates in higher education that exceed those of males from the respective cohorts. For individuals from the older cohorts, there is no significant gender difference in higher education participation rates. Carpenter and Fleishman (1987) find that while more women than men planned to enter into higher education, the actual entry into this activity did not differ significantly between men and women.

Williams and Carpenter (1990) and Long et al. (1995) use ordinary least squares and logistic procedures to examine the difference in higher education graduation rates between males and females. Both studies use the *Youth in Transition Survey*. While Williams and Carpenter (1990) found there was no gender difference in the completion of a degree for individuals in the 17 to 23 year age group from the 1961 cohort, Long et al. (1995) reported that 23 year old females from the 1961 and 1965 cohorts had slightly higher graduation rates than males. However, graduation rates for females were marginally lower than those of males among 30 year olds from the 1961 cohort.

The above discussion reveals that while there are gender differences in the educational attainment data reviewed in Figures 1 and 2, only small gender differences emerge in

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[6] While some of the studies focus on unconditional probabilities of participation in higher education, others focus on participation rates conditional upon having completed year 12. Finding explanations for differences in findings across the studies is therefore difficult.

multivariate models of educational attainment. Moreover, as argued by Long et al. (1999) and others, some of the factors generally included in the models of educational attainment may have different impacts for males and females. The extent of such differences can be gained from studies based on models of educational attainment estimated separately for males and females.[7] Again, a range of decision points, modelling techniques and explanatory variables have been used. Saha's (1982) analysis was based on survey data on secondary school students in Perth, Adelaide, Melbourne, Sydney, Brisbane, Hobart, Launceston and Canberra. In this analysis the school was viewed as a vehicle for the distribution of knowledge on occupations and on the credentials and abilities needed for their attainment. Hence the important link to examine was that between individuals' occupational plans (preferred and expected occupation) and their levels of schooling. This was done using regression analysis. It was concluded that, for both males and females, compared to those who left school in year 10, individuals who left school in year 11 or 12 had higher expected occupational status. The differential in the educational attainments of males and females was argued to arise because males generally needed to stay on until year 12, while females generally only needed to stay on until year 11, in order to achieve higher expected occupational status.

Carpenter and Western (1982) used survey data on year 12 students in Queensland to examine the impacts of structural, social-psychological and group variables on the educational aspirations of year 12 students. They found that father's occupation, mother's education, enrolment at a non-government school and interests in school were important determinants of educational aspirations for boys only. For girls, father's education and family income were important determinants of their educational aspirations. For both males and females, influences of teachers and parents and their own ability have significant impacts on their educational aspirations.

The importance of family background and social origins is also emphasised by Lamb (1989) and Le and Miller (2001). Lamb (1989) used survey data on secondary school students in Melbourne to examine how consumption of cultural activities (e.g., attending art exhibitions, opera) impacts on schooling aspirations among male and female students in year 10. Ordinary least squares regressions were used. It was argued that cultural consumption can influence educational aspirations directly via attitudes towards school. Alternatively, the extent of cultural consumption may simply reflect the individual's family social status, which has a positive association with educational attainment. The results indicated that cultural consumption was more important to boys' plans to undertake higher education than it was to girls' plans towards higher education. However, Lamb (1989) argued that more girls planned to undertake higher education than boys, and this difference could be due to the different opportunities available to girls and boys. In particular, Lamb (1989) noted a decline in the number of full-time jobs available for teenage girls while at the same time apprenticeships continued to provide an important source of employment for boys.

Data from the Australian Bureau of Statistics' *Survey of Employment and Unemployment Patterns* has been used by Le and Miller (2001) to provide information on the causes of

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[7] Equivalently, models can be estimated on data pooled across males and females with a full set of gender interaction terms.

the rise in educational attainment and on the changes in the male-female differential in this regard. Ordinary least squares and recursive estimations were used. Le and Miller (2001) found that the mother's education has a stronger influence on the educational outcomes of daughters than on those of sons. In contrast, the father's education is more important to the son's educational attainment than it is to the educational attainment of daughters. A similar finding is reported for the father's occupational status. However, when the model was estimated for females from different age groups, the father's occupation appeared to be a stronger determinant of the educational attainment of daughters in the younger age group (15-39 years) than it was for the older age group. There is little net change in the relationship between father's occupational status and the educational attainment of sons across the age groups analysed. The mother's education had a stronger impact on the educational attainments of both sons and daughters in the older age group (45-59 years) than it had for the younger age group (15-39 years). Similar results were obtained for the father's educational attainment. Le and Miller (2001) concluded, somewhat speculatively, that differences in gender educational attainment over time may be attributed mainly to the father's occupational status and changes in the labour market (e.g., Equal Pay decisions in 1969 and 1972). The latter influence was determined indirectly through examination of the time profile of changes in the estimated coefficients in the recursive models of educational attainment.

3. MODELS OF SCHOOL PARTICIPATION

This section briefly reviews models of educational attainment used in the Australian literature. This information will assist in the approach to be taken in the empirical section of the paper.

Educational attainment can be modelled in general form as

$$E_i = X_i\beta + \varepsilon_i \qquad (1)$$

where, for individual i, E is schooling level measured in years of full-time education, X is a row vector containing individual-related characteristics, information on the person's socioeconomic background and on their schooling origins, β is a column vector of weights to be estimated that link the variables in X to schooling level, and ε is a stochastic disturbance term.[8] As the dependent variable is viewed as a continuous variable, estimates of β are obtained using ordinary least squares (see for example, McGavin 1981; Carpenter & Western 1982; Miller 1983; Lamb 1989; Williams & Carpenter 1990; Le & Miller 2001).[9]

This approach has both strengths and weaknesses. In terms of strengths, the focus on the number of years of education completed appears to use all the data on educational

[8] Unless explicitly stated otherwise, the vector of regressors (X) in this study is defined to include a constant term.

[9] While the dependent variable in equation (1) is, in principle, censored at zero, the data under review are censored at 10. Predictions of negative values of the dependent variable are therefore not a consideration. The boundedness of the education data at 10 years could, nevertheless, be taken into account by the use of a Tobit model. Preliminary exploration showed that the Tobit model (with censoring at the lower bound of the education data used) yielded similar results to those obtained using OLS.

attainment available. The main weakness, however, is that any explanatory variable is argued to have the same impact at each level of education. This ignores the impact of crucial thresholds such as the completion of year 12 or the possession of post-secondary qualifications. This issue can be addressed by adopting an alternative, latent variable, approach as follows:

$$E_i^* = X_i\delta + \varepsilon_i \qquad (2)$$

where E_i^* is a latent (unobserved) variable that captures the propensity towards completion of a particular threshold level of education (e.g., year 10, year 12, post-secondary qualifications) of individual i, X is the vector of observed factors mentioned above, δ is a vector of coefficients to be estimated and ε is a stochastic disturbance term. Two observable outcomes may be derived from E^* with reference to an arbitrary threshold of zero. Thus, the individual is held to have completed the specific level of education ($E=1$) where E^* exceeds zero and has not completed this level ($E=0$) otherwise. This observed indicator variable (E) becomes the dependent variable in the analysis (see, for example, Williams & Carpenter 1990; Chiswick & Miller 1994). Estimates of δ can be obtained using probit or logistic procedures.

It is also possible to generalise the approach outlined in (2) above by examining the probability that an individual will achieve different thresholds of schooling (e.g., year 10, year 12, post–secondary qualifications) simultaneously rather than in isolation. A number of alternative approaches can be considered, including multinomial logit or probit models and ordered probability models (see, for example, Miller & Volker 1989; Vella 1994). The ordered probit specification has particular appeal given that years of education completed provide a natural ordering for the estimation procedure. Appendix 1 describes the main features of this model.

Given this range of methods of estimation, the main question for consideration is the variables for inclusion in the vector X. The specification of this differs across studies, though it is apparent that there is a common core. The variables included in most studies can be categorised as (i) personal characteristics; (ii) family background; (iii) regional, and (iv) institutional. Examples of each type are as follows.

Variable category	**Examples**
Personal	Year of birth, birthplace, gender, English proficiency, ability.
Family background	Parents' education, father's occupation, family size, family wealth.
Regional	Metropolitan/non-metropolitan areas, State of residence.
Institutional	School system.

4. METHODOLOGY

The studies reviewed in Section 2 have noted that there are gender differences in educational attainment and that these have changed over time. Various reasons for these changes have been advanced, such as changes in societal attitudes towards the role of women in the labour market, employment opportunities and family influences. There has not, however, been any systematic study of the cohort effects. Cohort effects, in the context of models of educational attainment, are influences on the education decisions that are unique to the group, whether it be because of the characteristics of the group (which is the typical rationale for cohort effects advanced in the immigration literature) or due to institutional, social or labour market factors that impact on the specific group who are making their schooling decisions at a particular point in time. There are several methods available for the study of gender differences and cohort effects that have been successfully utilised in the wage discrimination literature in Australia and overseas. The first method that can be used in a systematic study of cohort effects in educational attainment is an adaptation of the static decomposition used by Blinder (1973) to the study of changes over time in the gender wage differential. Hence, consider a model of educational attainment that sees the educational attainments of males (m) and females (f) being determined as follows:

$$E_m = X_m \beta_m + \varepsilon_m \tag{3}$$

$$E_f = X_f \beta_f + \varepsilon_f \tag{4}$$

where E is an indicator of educational attainment, X is the row vector of characteristics mentioned in Section 3 and β is a column of weights (coefficients) to be estimated that link the characteristics of individuals to their educational outcome.

Provided that these equations are estimated using a method that constrains the regression line to pass through the mean values of the sample, the difference between the educational attainments of males and females at a point in time can be decomposed as follows:[10]

$$\bar{E}_m - \bar{E}_f = \left(\bar{X}_m - \bar{X}_f\right)\hat{\beta}_m + \bar{X}_f\left(\hat{\beta}_m - \hat{\beta}_f\right). \tag{5}$$

In this equation the left-hand side is the difference in the mean educational attainments of men and women. The first term on the right-hand side gives the portion of the difference in the mean educational attainments of men and women that can be attributed to the difference in the mean levels of characteristics that they have (e.g., different levels of ability, different school types). It is given as the difference in the mean values of characteristics of males and females weighted by the way these characteristics translate into years of schooling for males. The second term on the right-hand side gives the portion of the difference in the mean educational attainments of the two groups that cannot be explained by the model. This term is due to the different ways that characteristics (e.g., family background) lead to educational outcomes for males and females. It is given as the difference in estimated coefficients from the models of

[10] See Blinder (1973).

educational attainment for males and females weighted by the mean values of characteristics for females.[11] The way this term is to be interpreted is open to some debate. One way of viewing it is that it is the changes in the mean levels of educational attainment of males and females that result from behavioural (either on the part of the individual, their family or society) differences between males and females.

When addressing the issue of cohort effects, the model outlined above can be extended in several ways. Appendix 2 contains details. A summary is provided below. First, changes over time within a gender group can be examined using an equation analogous to equation 5. Such a decomposition permits the change in the mean educational attainment of either males or females to be analysed in terms of two components. The first of these captures the impact on the growth in educational attainments of changes over the study period in the mean values of characteristics of the particular gender group. The second component captures the effect of changes over time in the ways that these characteristics are related to educational attainment. Drawing upon the earlier interpretation of this term, it will reflect the impact on the group's educational attainment that is associated with changes in the views of the individual, the family or society towards the educational achievement of the particular group. For example, if social reform over the study period is favourable towards female participation in education then this should be reflected in a positive value for this second component when changes in female educational attainment are being studied.

The second way in which the changes over time in educational attainment may be analysed is to simultaneously consider the time and gender dimensions. Under this approach the change from 1961 to 1970 in the difference between the mean educational attainments of males and females is examined. This change is decomposed into two components. The first of these components measures the portion of this change that can be linked to changes in the characteristics of males and females (e.g., the average measured ability of females increasing relative to that of males). The second component measures the portion of the changes in the mean educational attainments of males and females that cannot be explained by changes in the mean levels of characteristics of the two groups. This portion of the educational differential will thus record the impact of behavioural changes over the period under review that are advantageous to either males (where the values calculated are positive) or to females (where the values calculated are negative).

Hence, these methods offer a reasonably precise way of decomposing the gender differential in educational attainments at a point in time, and also changes in this differential over time, into various components. Once the sources of the differential and changes in the differential over time can be quantified in this way, attention can then focus on the factors that are isolated as contributing most to the differential under consideration. This methodology has been employed with excellent results in the gender wage discrimination literature.

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[11] The decomposition is not unique–see Blinder (1976). Various approaches have been advanced to deal with this, including using simple and weighted (by population shares) averages of the alternative decompositions that may be computed. Given the range of decompositions undertaken in this study, results are presented only for the particular decompositions outlined in this section.

A further method that can be employed in the analysis of gender differences in cohort effects stresses the links between gender and the other characteristics that are included in the model of educational attainment. This method is based on the following equation:

$$\alpha_t^m - \alpha_t^c = -\sum_{i=1}^{I} \beta_{t,i} b_{t,if} \ . \qquad (6)$$

where α_t^c will be the mean differential between the educational attainments of males and females at time t, α_t^m is the difference between the educational attainments of males and females at time t when other factors (such as family background, school type, measured ability) are held constant, $\beta_{t,i}$ is the estimated partial coefficient of the i^{th} control variable (at time t), and $b_{t,if}$ is the coefficient from a simple regression of the i^{th} control variable on the gender variable (for further information on this approach, see Johnson & Solon 1986; and Chiswick & Miller 1996). This equation can be implemented for various years (e.g., t = 1961, t = 1970). An across-time comparison of the decomposition of the term $(\alpha_t^m - \alpha_t^c)$ using this approach can show how the various links between gender and other determinants of educational attainment observed in practice (i.e., they are the links estimated using simple regressions) have changed over time to alter the female educational differential that is evident in Figure 1.

5. RESULTS OF MODELS: AN AGGREGATE ANALYSIS

The aim of this Section is to examine the determinants of educational attainment using a cohort approach. The analysis will be based on data from the *Youth in Transition* program of surveys. While it is recognised that cohort issues in educational attainment based on these surveys have been covered in studies such as Williams et al. (1993a), the distinguishing feature of the current investigation is the alternative, and more powerful, methodologies used, as outlined above. The *Youth in Transition* program covers four cohorts, namely individuals born in 1961, 1965, 1970 and 1975. Samples of each of these cohorts were included in longitudinal studies, where the focus was on school leaving decisions, the transition from school to work, post-school education and training, and early labour market performance. Two cohorts are selected for analysis, namely the 1961 and 1970 cohorts.

This section has a focus on two main issues: understanding the determinants of educational attainment and studying how these have changed over time. To advance the first aim, models estimated using only the 1961 data will be reported first. This will be followed by a discussion of models estimated using the 1970 data, which will permit preliminary insights into the stability or otherwise of the determinants of educational attainment. Finally, the data for the two cohorts will be merged in various ways to build on our understanding of the changes to the determinants of educational attainment over the decade under consideration. As the intention in the first instance is to establish an understanding of the basic patterns in the data, and how these have changed over the decade under review, equations are estimated on data pooled across males and females. The more general methodology involving analyses conducted separately for males and females will be followed in the next section.

It is noted that while the four *Youth in Transition* samples are nationally representative of the respective cohort, they are stratified two-stage cluster samples rather than simple random samples. Weights are available to reflect differences in the initial disproportionate stratification of the sample. As additional years of data were collected, the weights were adjusted to accommodate sample attrition. The actual weights that should be used in any analysis depend largely on the point at which the data to be examined were collected.

In the current analysis, the dependent variable is computed from information on secondary education decisions. For most of the sample this information is collected from the first one or two interviews (i.e., in 1978 or 1979 for the 1961 cohort, when the individuals were 17 or 18 years of age). Individuals who were still attending secondary school at the first or second interview were followed through time until (i) they made a decision with respect to their secondary schooling; or (ii) they were lost from the sample.[12] This could be at any interview after that conducted in 1978/1979 for the 1961 cohort. There are several ways that this group could be accommodated with the weighting procedures employed, and these involve adjustments to the other weights. As the numbers involved are small, and the adjustments that could be made are not unique (depending on the nature of the stratifications used), the weights that will be used are those available at the time of the initial data collection for the specific survey (i.e., 1978 for the 1961 cohort and 1985 for the 1970 cohort).[13]

One further aspect of the way the weights are applied in the current analysis needs to be noted. The weights for each separate analysis are scaled so that they sum to the actual number of observations used in the analysis. For example, if information on 2,722 individuals is used, and the original weights sum to 3,000, then these are scaled so that they sum to 2,722. This avoids complications associated with inflation or deflation of test statistics through the use of weighted sample sizes that do not correspond to the actual sample sizes. It also allows readers to see from the sample size listed in each table the actual number of observations employed in any analysis.

1961 Cohort

In this section several models of educational attainment for the 1961 cohort will be discussed. Members of this birth cohort will have mainly been making their educational decisions during the mid-1970s. As noted in Section 2, this was a period of rapid change in the participation rates of both males and females, but particularly in the latter. The first part focuses on the educational attainment of individuals using least squares models. This segment of the analysis is based on a dependent variable that measures the number of years of schooling completed. The second part of the discussion looks at the probability of completing years nine, 10, 11 and 12 using ordered probit models.

It is noted that the analyses undertaken focus exclusively on the amount or level of secondary school undertaken. Post-secondary education is not incorporated into the study. There are several reasons for this. First and foremost, the important decision

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[12] This represents a different approach to that adopted in the studies based on these data that were discussed earlier.

[13] The correlation between the weights for the first three years of the survey are generally well in excess of 0.9.

points in models of educational attainment are at years nine through 11. The acquisition of tertiary qualifications appears to be governed largely by decisions made about completing year 12 (see Miller & Volker 1989, Williams & Carpenter 1990). Second, attrition bias in the longitudinal data set is closely linked to age and mobility status. Both these characteristics are, in turn, related to whether the individual undertakes post-secondary education. While there are weights available in the data set to compensate for sample attrition (see Williams 1987), it is not clear that this approach will be effective in relation to post-secondary education, where due to the elapse of time, the extent of sample attrition is much greater than in the case of the secondary education decisions. Moreover, it is well established that while the weights can, in principle, correct for attrition bias related to observable characteristics, they do not necessarily overcome attrition bias related to unobservable characteristics (see Fitzgerald, Gottschalk & Moffitt 1998). Restricting attention to secondary school decisions will minimise the potential for non-random attrition, particularly that associated with unobservable characteristics, to bias the estimates.

The mean level of education for the 1961 cohort is 12.07 years, and the standard deviation is 0.99 years. Thus, there is a reasonable amount of variation in the educational attainment data that needs to be explained by the personal, socio-economic background and schooling origins variables included in the model. The results for the weighted least squares (WLS) model that attempts to account for this variation are presented in Table 1.[14] For this model the F statistic for the test of whether all slope coefficients are simultaneously equal to zero is a highly significant 49.29. The adjusted R^2 of 0.25 is reasonable for a cross-sectional model of educational attainment.[15] Most of the explanatory variables are highly significant, which suggests that the model will provide an excellent basis for the study of the reasons for changes in educational attainment over time.

The first variable listed in this table is that which distinguishes between males and females. The coefficient on the gender variable is highly significant (t=2.04) and the magnitude of 0.079 indicates that females have about one-tenth of a year more education than males, *ceteris paribus*. This information is consistent with the data in the second half of the time period covered in Figure 1. However, this result differs from Le and Miller (2001). They find that females receive less education than males. This may be due to the different natures of the studies. The Table 1 results deal with a single birth year cohort (1961) that would have been making their education decisions around the mid- to- late 1970s. Le and Miller's (2001) study is based on a cross-section of people born between 1936 and 1980. Many of these people would have made education decisions in eras where female participation rates in higher education were well below those of males (see Fig. 1).

[14] Appendix 3 contains a brief description of the variables used in the statistical analysis, as well as the means and standard deviations of these variables.

[15] The R^2 for the weighted data is computed in the usual way and has the interpretation of being the goodness of fit in a weighted regression of the actual schooling level on the predicted schooling level.

Table 1 WLS Estimates of Schooling Level—1961 Cohort, Pooled Sample

Variable	*Coefficient*	*t-ratio*
Intercept	8.731	10.73
Personal characteristics		
Female	0.079	2.04
Individual ability	0.049	20.23
Non-English speaking parents	0.278	5.62
Youth born in non-English speaking country	0.099	1.15
Socioeconomic background		
Father's occupational status	0.007	6.82
Father's post-secondary qualification	0.217	4.27
Mother's post-secondary qualification	0.022	0.42
Number of siblings	-0.030	-3.10
Wealth	0.027	1.53
Schooling origins		
Catholic schools	0.267	5.65
Other independent schools	0.218	4.22
Schools in non-metropolitan areas	-0.124	-3.41
ACT	0.390	3.11
Victoria	0.160	3.78
Queensland	0.132	2.47
South Australia	0.272	5.04
Western Australia	0.111	1.73
Tasmania	-0.069	-0.68
Northern Territory	0.294	0.70
F(19, 2 751)	*49.29*	
Adjusted R^2	*0.25*	
Sample size	*2 771*	

Note: The t-ratios are formed using heteroscedasticity-consistent standard errors (see White 1980).

Whether the individuals continue with their schooling can also depend on their ability/achievement. An individual's ability is measured in this analysis of the 1961 cohort by literacy and numeracy scores obtained when they were 14 years old. This variable has been interpreted as the skills possessed or trainability of the individuals (Williams et al. 1993b, p.86). The results from Table 1 indicate that this measure of ability has the highest marginal significance level. The ability measure has a mean for the sample used in this analysis of 57.18 points and a range from 23 to 66 points. As the coefficient on the variable is 0.049, a 20 points increase in the ability measure would be associated with about an extra year of schooling. This finding is consistent with Williams et al. (1993a) who report a strong, positive association between an individual's ability and schooling.

Another individual-related characteristic that has been shown to affect educational attainment is place of birth. On this matter, there are two schools of thought. Proponents from the first school of thought argue that individuals from, or those with parents from, non-English speaking countries have to face the problems associated with migration as well as the problems of learning a new language (Long et al. 1995). Given these circumstances, those from non-English speaking background should acquire less education than those born in Australia or migrants from English-speaking countries. An alternative view is that non-English speaking parents are associated with higher educational attainment of their children. Birrell (1987) shows that the proportion of migrant students staying on after year 9 to complete high school is higher than that of Australian-born students. He argues that, compared to Australian-born children, migrant children have higher educational aspirations, experience greater parental pressure to achieve and apply themselves more in schools. These factors help migrant children to overcome any handicaps associated with lower socioeconomic status or linguistic difficulties. The Table 1 results do not suggest any general ethnic disadvantage in educational attainment among non-English speaking migrants. If anything the converse applies, with individuals who have at least one parent who was born in a non-English speaking country having, on average, about three and a half months of schooling more than either those with Australian-born parents or those whose parents were born in English-speaking countries. This is consistent with the results reported by Miller and Volker (1989) and Williams et al. (1993a).

The variables recording the socioeconomic background of the individual's family are reasonably important determinants of educational attainment. There are a number of dimensions of family background. Parents' occupation can be used to index the social status of families. Social status captures differences in lifestyles and life chances of different groups, such as views about the worth of education as an investment, as a positional good and as a consumer good (Williams et al. 1993b). Parents' occupation can be incorporated into the model using membership of specific occupations (Le & Miller 2001) or by using a measure of socioeconomic status. Generally only the father's occupational attainment is considered owing to the high proportion of mothers listing household duties as the main activity while the child was growing up.[16] The father's occupational status is used in this study to index the social status of families. This variable is coded to the ANU2 occupational prestige scores (see Broom et al. 1977). From Table 1 it can be seen that individuals whose fathers were employed in high-status jobs have more education than those whose fathers were employed in low-status occupations. This result is consistent with studies by Miller and Volker (1989), Williams et al. (1993a) and Le and Miller (2001). Williams et al. (1993a) suggest that higher status families are able to provide higher levels of psychological support which increases the likelihood of their children completing school.

The parents' education can influence the children's educational attainment in two ways. First, the parents' education may be related to social status and wealth. However, as the regression analysis includes controls for these factors, other measures of influence must be considered. Second, better educated parents can serve as a role model for their children and may provide more encouragement and superior advice than less educated parents.

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[16] This is not to argue that such activity is not important, only that it is difficult to measure in conventional ways.

Several approaches can be considered with respect to the way parents' education is included in the analysis. Variables for each parent's educational attainment can be included in the model (see Williams & Carpenter 1990, Le & Miller 2001). Alternatively, only a variable for the mother's educational attainment might be included on the grounds that the mother exercises the greater influence with respect to the 'role model, encouragement and advice' motivations (see Williams et al. 1993a, 1993b and Long et al. 1995). A third possibility is to include the father's educational attainment when considering the schooling of sons, and the mother's education when considering the educational attainment of daughters. This follows from findings such as those reported by Miller and Volker (1989) where the father's education has a stronger impact on the son's schooling while the mother's education has a stronger impact on the daughter's schooling.

In this paper, the parents' educational attainment is captured separately for the father and mother. The results show that individuals with fathers who have a post-secondary qualification have one-quarter of a year more schooling compared to those with fathers who have only secondary or primary school education. Whilst this effect is obviously of importance, it is not anywhere as important as that associated with ability. Moreover, the impact of the mother's educational attainment is not significant. This is different from the results from Le and Miller's (2001) study where both parents' educational attainments have significant influences on an individual's own education.[17] Miller and Volker's (1989) study reveals that the net impact of the mother possessing a university degree is greater than that of the father possessing a similar qualification. These differences could reflect the different time periods covered in the various analyses: Le and Miller's (2001) recursive estimations reveal that both parents' educational attainments have stronger influences on the educational attainment of an older age group (45-59 years) than on the educational attainment of a younger age group (15-39 years). The first age bracket of 45-59 year olds would have made their educational decisions before the late 1960s while the second age bracket of 15-39 would have made their educational decisions after 1969.

Family size is assumed to have a negative impact on an individual's educational attainment. This arises mainly because of the links between expenditure per child and the number of children. The Table 1 results indicate that an additional child in the family reduces the educational attainment of an individual by a modest amount.[18] The standardised difference between the educational attainment of a singleton and a person with seven siblings is similar to that between an individual whose father has or does not possess post-secondary qualifications. Similarly, Miller and Volker (1989) show that as the number of siblings increases there is a reduction in the probability of an individual completing the minimum schooling required as well as a reduction in the probability of completing high school.

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[17] The results are however, broadly in line with those reported by Williams and Carpenter (1990).

[18] Becker and Lewis (1973), among others, draw attention to a 'quantity'–'quality' trade off in family decision making. One index of the quality of children is educational attainment. While the inverse relationship between educational attainment and family size is certainly consistent with this thesis, it is not generally considered a test of the 'quantity'–'quality' interaction: this is generally tested through examination of the signs of the coefficients on variables in equations estimated to assess the determinants of family size and child quality.

The educational attainment of individuals may depend on the type of school they attend. The type of school may reflect differences in characteristics of the students or differences in the quality of schooling received. While the regression analysis includes a number of variables to standardise for the characteristics of individuals, the modest value for the R^2 suggests that the list of standardising variables is far from complete. If some of the variables that influence educational attainment that are omitted from consideration also affect the decision to enroll in Catholic or Independent schools, then the school type variables will capture this indirect impact in addition to any direct impact they have on the level of schooling. The Table 1 results show that, compared to those enrolled in government schools, students in Catholic or Independent schools have about three more months of schooling. Similarly, Miller and Volker (1989) report that students in Catholic and Independent schools are more likely to complete both the minimum schooling requirement (year 10) and high school.

Previous studies (e.g., Miller & Volker 1989; Williams et al. 1993a) have shown that there exists a rural/urban educational attainment differential. This difference may reflect the disadvantage of distance and isolation in rural areas, differences in psychological orientation towards school participation that are based on the values and orientation of families in different regions, the level of local employment and the income of families. Furthermore, rural schools experience higher teacher turnover, lack of specialist services as well as a restricted range of curriculum options (Williams et al. 1993a, 1993b) that would be expected to impact on the educational aspirations and completed educational attainments of rural area students. The result in this paper shows that, compared to the individuals attending schools in the metropolitan areas, those attending schools in non-metropolitan areas receive almost one and a half months less schooling. Similar findings are reported by Miller and Volker (1989).

The level of education may also differ across States and Territories. State and Territory differences may reflect differences between the population characteristics of each location, the education system, and/or labour market conditions. The results in Table 1 show that, compared to individuals residing in New South Wales, those living in the ACT, Victoria, Queensland, South Australia and Western Australia receive more schooling. The impact of the ACT variable on schooling is the largest. Similarly, Miller and Volker (1989) show that students in the ACT, Victoria, Queensland and South Australia are more likely to continue schooling beyond year 10 than those in New South Wales, while Tasmanian students are less likely to continue beyond year 10. Miller and Volker (1987) also report that, conditional upon completing year 11, students in Victoria, South Australia, Western Australia and the Northern Territory are less likely to complete year 12 than those from New South Wales.

As well as reviewing the partial effects in Table 1, elasticity measures may also be examined. These are unit free measures defined as the percentage change in the level of education per percentage point change in a specific independent variable. Table 1 does not present these as all variables other than ability, father's occupational status, number of siblings and the insignificant wealth variable are binary. Being discrete, discussion of small percentage changes for these other variables is not appropriate. With the continuous variables, the elasticities can be calculated at the mean of the variables, or at other points in the distribution (for example, one standard deviation above or below the mean). In the latter case, an issue that needs to be dealt with is the value of the dependent variable to use with the values of the explanatory variables. In the following

table, the elasticity of schooling level with respect to ability, father's occupational status and the number of siblings is calculated at the means of both the explanatory variables and the level of schooling, and also at one standard deviation above and below the mean of the explanatory variables. For the latter calculations, the level of schooling is adjusted by the marginal impact of the explanatory variable under consideration, so that the elasticity measure is given as $\frac{\partial S}{\partial X} * \frac{\overline{X} + \Delta X}{\overline{S} + \frac{\partial S}{\partial X} * \Delta X}$.

Variable	*Elasticity at mean*	*One s.d. above mean of variable*	*One s.d. below mean of variable*
Individual ability	0.232	0.254	0.209
Father's occupational status	0.021	0.031	0.010
Number of siblings	-0.007	-0.012	-0.002

The elasticity measures calculated are reasonably small, and do not vary appreciably across the range of the data considered. This reflects the linear nature of the model estimated and the small partial effects established. For example, a one per cent increase in measured ability is estimated to be associated with a 0.232 increase in educational attainment at the mean, and a 0.254 percentage point increase among ability levels one standard deviation (i.e., about 7.08 points) above the mean (of 57.18 points).

An alternative approach to analysing the overall schooling attainment of individuals is to look at the probability of reaching a particular schooling level. Table 2 presents the results from the ordered probit model that is discussed in Appendix 1. This model predicts the probability of individuals completing years nine, 10, 11 and 12.[19] Overall, the results are similar to those obtained from the educational attainment models estimated using the weighted least squares procedure (see Table 1). In addition, the results in Table 2 are consistent with those reported by Miller and Volker (1989) and Williams et al. (1993a).

The discussion of the estimated coefficients in the ordered probability model will be couched in terms of general patterns only. This approach is taken because interpretation of the estimated coefficients in an ordered probit model is made difficult by the fact that a particular sign on a coefficient can be associated with an unambiguous change in the predicted probability of membership of only the highest and lowest education levels (see, for example, Greene 1991 p.704).

[19] Logit analysis of the probability of completing year 12 was also undertaken. The results can be obtained from the authors. They are used in a number the decompositions presented in later sections of this study.

Table 2 Ordered Probit Estimates of Model of Education Levels—1961 Cohort, Pooled Sample

Variable	*Coefficient*	*t-ratio*
Intercept	-2.265	-12.62
Personal characteristics		
Female	0.093	2.59
Individual ability	0.062	23.17
Non-English speaking parents	0.407	7.69
Youth born in non-English speaking country	0.158	1.57
Socioeconomic background		
Father's occupational status	0.010	9.16
Father's post-secondary qualification	0.381	5.79
Mother's post-secondary qualification	0.062	0.76
Number of siblings	-0.033	-3.91
Wealth	0.035	1.74
Schooling origins		
Catholic schools	0.394	7.78
Other independent schools	0.407	4.42
Schools in non-metropolitan areas	-0.156	-4.19
ACT	0.685	1.48
Victoria	0.185	4.49
Queensland	0.195	3.07
South Australia	0.305	3.15
Western Australia	0.141	1.30
Tasmania	-0.091	-0.35
Northern Territory	0.310	0.18
μ_2 (a)	1.624	42.79
μ_3	2.135	53.90
χ^2 (19)	750.78	
McFadden R^2 (b)	0.12	
Sample size	2 772	

Note: (a) The $\hat{\mu}$ s are estimates of the separation points that appear in equation (1.2).

(b) The McFadden R^2 is calculated as $1 - (l_m/l_o)$, where l_m = the maximised log-likelihood value of the model and l_o = the log-likelihood value if the non-intercept coefficients are restricted to zero (see Veall & Zimmermann 1996).

In terms of personal characteristics, the Table 2 results show that being female has a positive impact on the underlying index of educational attainment. In the ordered probit model estimated here this means that females have a higher probability than males of completing year 12, and a lower probability of being an 'early school leaver' (i.e., leaving at year nine or earlier). The impact of being female on leaving at the end of year

10 or year 11 is ambiguous.[20] The magnitude of the coefficient is similar to that obtained from the least squares model. These results are consistent with Williams et al. (1993a). An individual's ability has a positive and significant influence on schooling level. The size of the coefficient is comparable to that reported in Table 1. The positive relationship between an individual's ability score and his/her educational attainment is also reported by Williams et al. (1993a). They find that the top 25 per cent of the students have a year 12 completion rate which is more than double that of the lowest 25 per cent of the students.

Finally, individuals with at least one parent born in a non-English speaking country are more likely to leave school later than either those with Australian-born parents or those whose parents were born in English-speaking countries. That is, there is strong evidence that children from non-English speaking background are not disadvantaged in their schooling, where disadvantage is measured by the standardised level of schooling completed. It would appear as if education is seen by immigrant parents from non-English speaking countries as a way of promoting the future socioeconomic success in Australia of their children.

With regard to socioeconomic and family background variables, the father's occupational status, the father's educational attainment, the size of the family and wealth significantly influence the individuals' educational attainment. These results are similar to those reported in Table 1, both in terms of statistical significance and relative magnitude. For example, having a father who has a post-secondary qualification is associated with higher schooling levels in both sets of analyses, and the impact is about the same as that associated with having at least one parent born in a non-English-speaking country in both Tables 1 and 2. Likewise, the relationship between the father's occupational status and schooling level is positive in the models presented in Tables 1 and 2. In other words, the empirical findings associated with the variables recording the socioeconomic background of the individual are quite robust across the different models employed. These results are also consistent with those reported by Williams et al. (1993a). They show that the impact of the mother's educational attainment on an individual's own educational attainment works primarily through having a mother with post-secondary education. In addition, they show that an individual with a father in the highest occupational status category is more likely to complete year 12 compared to an individual with a father in a lower occupational status category.

The type of school the individuals attended has a very large influence on their chances of completing higher levels of schooling. Thus, compared to individuals who attended government schools, those enrolled in Catholic and other Independent schools are more likely to complete year 12 and are less likely to leave school before year 10. Similarly, Williams et al. (1993a) show that the year 12 completion rate difference between government and other Independent schools is 27 percentage points. As both the Williams et al. (1993a) and the current set of analyses control for individual-related characteristics and family background, these results suggest that the type of school could be capturing

[20] This issue can be examined by constructing predicted distributions of membership of each of the school leaving categories. As the main objective of this study is to investigate cohort effects, predicted distributions will not be examined here.

differences in the quality of schooling (see also Williams et al. 1993a).[21] Together with the Table 1 results, this suggests that non-government schools are quite successful both in terms of getting students to complete the minimum schooling requirement and also having students continue into year 12.

The Table 2 results also indicate that school location has a significant influence on the level of schooling. For example, compared to individuals attending schools in the metropolitan areas, those attending schools in non-metropolitan areas have a lower probability of finishing year 12 and a higher probability of leaving school early. Williams et al. (1993a) suggest that the difference in high school completion rates between rural and urban areas primarily reflects differences between rural and urban families rather than the physical distance and isolation factors generally associated with non-metropolitan regions.

A number of the State and Territories variables have significant impacts on the schooling levels. It should be noted that residence in the ACT has the largest impact on schooling, though this effect is not statistically significant. The size of the point estimate for the ACT relative to that for other areas is, however, consistent with Williams et al. (1993a) where, compared to students in other parts of Australia, students in the ACT had the highest rate of year 12 completion.

Summarising the above, it is seen that most variables included in the models affect the educational attainments analysed in ways that both appear intuitively reasonable and are consistent with the literature. There is a high degree of consistency to the findings obtained from the least squares and ordered probit analyses. This indicates that the results pertaining to individual-related characteristics, socioeconomic background of families and schooling origins are quite robust across model specifications.

1970 Cohort

The focus of this Section is a comparison of the changes in educational attainment between the 1961 and 1970 cohorts. An overview of the results for the 1970 cohort will first be presented.[22] Then the changes in educational attainment over time will be discussed in some detail.

The results from least squares and ordered probit models of educational attainment for the 1970 cohort are presented in Tables 3 and 4 respectively. The mean educational attainment for this group is 12.35 and the standard deviation is 0.93. Thus, over the period 1961-70, there was an increase of one-third of a year in the mean level of schooling of the cohorts. In general, the results from the models that attempt to account for the higher educational attainment of the 1970 cohort are quite robust across model specifications and are reasonably similar to those already discussed for the 1960 cohort. Given this similarity the discussion will be relatively brief and will focus mainly on the Table 3 results.

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[21] As noted above, the school type variables could capture the influence of individual characteristics other than those included in the model which influence the type of school attended. Included might be aspirations towards socioeconomic progress.

[22] Appendix 3 contains the means and standard deviations of the variables used in the educational analysis for the 1970 cohort.

Table 3 WLS Estimates of Schooling Level—1970 Cohort, Pooled Sample

Variable	*Coefficient*	*t-ratio*
Intercept	9.859	14.40
Personal characteristics		
Female	0.078	1.93
Individual ability	0.040	11.70
Non-English speaking parents	0.171	3.28
Youth born in non-English speaking country	0.235	2.24
Socioeconomic background		
Father's occupational status	0.002	1.49
Father's post-secondary qualification	0.106	2.25
Mother's post-secondary qualification	0.116	2.48
Number of siblings	-0.053	-3.28
Wealth	0.027	1.51
Schooling origins		
Catholic schools	0.260	5.44
Other independent schools	0.440	8.92
Schools in non-metropolitan areas	-0.010	-0.22
ACT	0.245	2.06
Victoria	0.093	1.80
Queensland	0.102	1.59
South Australia	0.226	3.12
Western Australia	-0.072	-0.95
Tasmania	-0.270	-2.38
Northern Territory	0.207	1.03
F(19, 1 693)	*24.72*	
Adjusted R^2	*0.21*	
Sample size	*1 713*	

Note: The t-ratios are formed using heteroscedasticity-consistent standard errors (see White 1980).

The personal characteristics that have a significant impact on educational attainment are birthplace, an individual's ability and gender (at the six per cent level in the WLS estimates). For example, individuals with at least one parent born in a non-English speaking country receive about two months more schooling than individuals with parents who were both born either in Australia or abroad in an English-speaking country. There is a further positive impact on schooling level where the individual was also born abroad in a non-English speaking country. The impact of an individual's ability on educational attainment is positive, and quite pronounced: an increase in the ability score by 20 points is associated with an increase in the schooling level of an individual by about 10 months. Educational attainments for females are significantly higher than for males, and the estimated differential in education levels of about one month is the same as reported in Table 1 for the 1961 cohort.

Table 4 Ordered Probit Estimates of Model of Education Levels–1970 Cohort, Pooled Sample

Variable	*Coefficient*	*t-ratio*
Intercept	-1.083	-5.50
Personal characteristics		
Female	0.129	2.62
Individual ability	0.051	16.73
Non-English speaking parents	0.244	3.73
Youth born in non-English speaking country	0.633	2.42
Socioeconomic background		
Father's occupational status	0.004	2.21
Father's post-secondary qualification	0.217	3.46
Mother's post-secondary qualification	0.192	2.78
Number of siblings	-0.078	-5.07
Wealth	0.044	2.02
Schooling origins		
Catholic schools	0.411	5.98
Other independent schools	1.000	7.42
Schools in non-metropolitan areas	0.001	0.03
ACT	0.485	1.22
Victoria	0.063	1.06
Queensland	0.148	2.09
South Australia	0.258	1.79
Western Australia	-0.104	-0.79
Tasmania	-0.369	-1.65
Northern Territory	0.181	0.20
μ_2 (a)	1.458	26.71
μ_3	1.879	33.25
χ^2 *(19)*	*432.00*	
McFadden R^2 (b)	*0.13*	
Sample size	*1 713*	

Note: (a) The $\hat{\mu}$ s are estimates of the separation points that appear in equation (1.2).

(b) The McFadden R^2 is calculated as $1 - (l_m/l_o)$, where l_m = the maximised log-likelihood value of the model and l_o = the log-likelihood value if the non-intercept coefficients are restricted to zero (see Veall & Zimmermann 1996).

The socioeconomic background of the family and schooling origins variables that are significant determinants of the level of education include the parents' educational attainments, family size and the type of school attended. For example, having a father and a mother who have post-secondary qualifications each increases the schooling level of individuals by about one month. The significant impact of both parents' educational

attainments on the educational attainments of their children is consistent with Le and Miller (2001). Having a sibling significantly reduces an individual's overall schooling. The reduction in schooling level associated with having two siblings is sufficiently large that it would offset the positive impact on schooling level associated with having a parent who possesses a post-secondary qualification.

The impact of the type of school attended on an individual's educational attainment is reasonably important. For example, individuals who attended Catholic and Independent schools have three months and five months, respectively, more schooling than individuals who attended government schools. Overall, these results are broadly consistent with Williams et al. (1993a) who find a large difference in the probability of students completing year 12 between government and non-government schools.

Comparison of 1961 and 1970 Cohorts

While the above analysis provides a detailed account of the educational attainment of individuals at specific points in time, it is useful to examine the changes in educational attainment over the decade (1961 to 1970). There are three ways to proceed in this regard. First, formal tests for structural change in the estimated relationships between 1961 and 1970 may be considered. Second, individual estimates can be examined to see if they change over time. Third, the decomposition method due to Blinder (1973) that was outlined in Section 4 can be implemented. Each of these approaches is considered below.

The first approach to analysing differences in educational attainment over time is to undertake formal tests for structural change. A Chow test was undertaken and the computed F value of 9.80 suggests that the structure of the estimated relationship for 1970 differs from that for 1961. That is, some or all of the parameters of the model of educational attainment have changed between the 1961 and 1970 cohorts. In order to ascertain which coefficients may have altered, each coefficient for 1970 can be compared to its counterpart in 1961. This study of changes in individual coefficients will focus on the weighted least squares results. Table 5 contains t-statistics for each of the variables listed in Tables 1 and 3. The t-statistics show if the variables differ significantly between the 1961 and 1970 cohorts. They have been computed from a regression estimated on data pooled across the two data sets with a full set of interaction terms. Hence, they take into account the covariances between variables.

There are four slope coefficients that differ statistically (at the five per cent level or higher) in the two sets of analyses, namely those for the ability, father's occupational status, other independent schools and schools in non-metropolitan areas variables. The intercept term also differs significantly between the estimated relationships for the 1961 and 1970 cohorts.

A comparison of the results in Tables 1 and 3 shows that the magnitude of the impact of individual ability has declined significantly over the decade. This result is consistent with analyses of the same data by Williams and Carpenter (1990), Williams et al. (1993a) and Marks et al. (2000). Note, however, that the measurement of this variable differs between the 1961 and 1970 cohorts. For the 1961 cohort the variable is measured at age 14 while for the 1970 cohort the variable is measured at age 10. The findings reported in this study and in the analyses by Williams and his colleagues and Marks and his colleagues may therefore simply mean that literacy and numeracy skill measures taken later in the school career are more meaningful predictors of schooling level than those

taken earlier in the school career. This is an intuitively reasonable proposition. Nevertheless, regardless of whether the measurements are recorded at ages 10 or 14, for each cohort analysed the literacy and numeracy scores are the strongest predictors of schooling level among those included in the models presented in this study.

The impact of the father's occupational status on an individual's schooling is smaller for the 1970 cohort than for the 1961 cohort. This is consistent with the results from Marks et al. (2000) who reported a decline in the influence that fathers in professional occupations have on year 12 participation of their children. It is also noted that, while the changes are not statistically significant, the impact of the father's post-secondary education on an individual's schooling has declined over time, while the mother's post-secondary qualification variable is a more important determinant of an individual's schooling for the 1970 cohort than for the 1961 cohort. These changes are broadly consistent with Le and Miller (2001) and suggest a relative strengthening of the influence of the mother as a role model as females take a more active role in the labour market, society and, arguably, family decision making.

Table 5 The Level of Significance of Differences of Variables between the 1961 and 1970 Cohorts

Variable	*t-ratio*
Constant	4.38
Personal characteristics	
Female	-0.03
Individual ability	-2.24
Non-English speaking parents	-1.49
Youth born in non-English speaking country	1.00
Socioeconomic background	
Father's occupational status	-3.50
Father's post-secondary qualification	-1.59
Mother's post-secondary qualification	1.33
Number of children	-1.21
Wealth	0.001
Schooling origins	
Catholic schools	-0.10
Other independent schools	3.10
Schools in non-metropolitan areas	1.90
ACT	-0.83
Victoria	-0.99
Queensland	-0.36
South Australia	-0.52
Western Australia	-1.83
Tasmania	-1.31
Northern Territory	-0.19

With regard to the schooling origin variables, a comparison of the estimates in Tables 1 and 3 shows that the impact the Independent schools variable has on the educational attainment of individuals has increased over the decade. The reason for this difference is unclear. At the aggregate level it is well known that the proportion of school students attending non-government schools has increased considerably over the past two decades. Hence, between 1949 and 1999 the number of students attending government schools increased by 132 per cent while the number of students attending non-government schools increased by 279 per cent. Apparent retention rates for both government and non-government school systems increased over the period when the 1961 and 1970 cohorts would have been making their school leaving decisions, though retention rates for school types are difficult to interpret because of the net transfer of students from government to non-government schools.[23] Experiments show that the results are sensitive to the way the school type variable is measured for the 1970 cohort. There is a minor difference in the way the school type variable has been measured in the analyses undertaken for the 1961 and 1970 cohorts (see Appendix 3), and the almost doubling of the impact Independent schools have on education levels could be associated with this change in measurement. However, the estimated impact for the Catholic school variable is quite similar in the analyses undertaken for the two cohorts. As this variable is also measured differently for the two cohorts, the contrast in the findings for the Independent and Catholic schools variables suggests that the doubling of the impact that Independent schools have on education levels may mostly be a school-type effect rather than a consequence of changes in measurement of the variable. In contrast to the findings reported here, Marks et al. (2000) showed that the likelihood of year 12 participation among students from Independent schools from the 1961 cohort is much higher than that for students enrolled in Independent schools who are from the 1970 cohort. Marks et al. (2000) also report that the advantage Independent schools have over government schools in encouraging participation in year 12 has declined since 1970.[24] One of the reasons for the difference in findings reported by Marks et al. (2000) and in the current study is the way the schooling variable is defined in the analysis of the 1970 cohort. Marks et al. (2000 p.49) report that this was constructed from information on the school categories in the student's first year of secondary school (year seven). In the current study it is constructed from information on the category of school at a later period (modal year being year 10). In comparison, the data on school system from the 1961 survey was defined with reference to the school system attended at age 14 (modal year was year nine). Selective transfers across school systems in favour of high completion rate schools will lead to an accentuation of the impact of type of school in the current study and a diminution of the impact in the study by Marks et al. (2000).

Finally, it is noted that the intercept term is about one (year) greater in the model of educational attainment estimated for the 1970 cohort than it is for the 1961 cohort. This change can be due to several factors. First, it could be associated with changes in the way variables are measured. There are two notable changes that will be important in this regard, namely the measurement of ability at age 10 for the 1970 cohort rather than at age 14 for the 1961 cohort, and the measure of school system was obtained as part of the

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[23] Relating the findings from this study to changes in apparent retention rates is an area for future research.

[24] In addition, the advantage that schools in metropolitan areas have over schools in non-metropolitan areas has declined over the decade, and this change is significant at the 10 percent level.

sampling design for the 1961 cohort (modal year for which this measure was obtained was year nine) while for the 1970 cohort school type refers to the school individuals attended in 1985 (modal year being year 10). Second, it could be associated with changes in the mean values of, or impacts on educational attainment of, variables that are not included in the model. Examples of such influences might include societal attitudes towards the importance of schooling.

Analyses can also be undertaken of the changes in the probability of individuals reaching a particular level of schooling (compare Tables 2 and 4). In general, the changes discussed above are also apparent in the analyses based on the ordered probit model. There is, however, a difference of note, namely the gap between the impacts that government and Independent schools have on education levels has widened by a greater amount in the ordered probit model than in the weighted least squares model.

The final set of analyses to be presented in this section are for the Blinder decomposition of the difference in the mean educational attainments of the 1961 and 1970 cohorts into components due to differences in the measured characteristics of the two cohorts and due to differences in the impacts that these measured characteristics have in the models of educational attainment estimated for the 1961 and 1970 cohorts. Relevant details are presented in Table 6.[25] As well as the decomposition for the mean level of schooling (first two columns of figures) this table also presents a decomposition of the difference in the year 12 completion rate based on the logit equation mentioned in footnote 19 (last two columns of figures). The methodology used in the second set of calculations is outlined in Appendix 4. It is noted that owing to the non-separable nature of the logit model it is not possible to decompose the explained (due to differences in characteristics) and unexplained (due to differences in estimated coefficients in the models of year 12 completion) components into parts due to each of the variables.

The decomposition results based on the weighted least squares model show that the educational attainment difference between the 1961 and 1970 cohorts is 0.275 of one year. This difference is largely attributable to changes over time in the way the characteristics listed are related to educational attainment, with the value of the aggregate unexplained component being 0.318 and that of the aggregate explained component being –0.043. The positive value of the unexplained component indicates that the changes that have occurred have been associated with greater educational attainment for individuals.

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[25] It should be noted that with regard to the decomposition in Table 6, it is not possible to provide a unique partition of the unexplained component of the difference in educational attainment across cohorts (into differences in the slope coefficients and differences in the intercepts) when categorical variables have more than two categories (see Jones 1983). The variable for the State/Territory in which the individual attended school, for example, has eight categories in the analyses undertaken, while type of school has three categories. Therefore, the decomposition presented here should be regarded as illustrative of the broad trends only.

Table 6 Decomposition of the Change in Educational Attainment between 1961 and 1970 Cohorts

	Levels of Education		Year 12 Completion Rate	
Variable	*Explained*	*Unexplained*	*Explained*	*Unexplained*
Total Educational Difference	*0.2750*		*14.93*	
Total Explained	*-0.0432*		*-2.50*	
Total Unexplained		*0.3182*		*17.43*
Intercept	—	1.1277		
Female	0.0024	-0.0007		
Individual ability	-0.1401	-0.5369		
Non-English speaking parents	0.0067	-0.0191		
Youth born in non-English speaking country	-0.0043	0.0055		
Father's occupational status	-0.0006	-0.1932		
Father's post-secondary qualification	0.0165	0.0085		
Mother's post-secondary qualification	0.0180	0.0443		
Number of siblings	0.0262	-0.0644		
Wealth	0.0110	0.00009		
Catholic schools	0.0108	-0.0011		
Other independent schools	0.0122	0.0174		
Schools in non-metropolitan areas	0.0006	0.0443		
ACT	0.0012	-0.0020		
Victoria	-0.0020	-0.0190		
Queensland	0.0012	-0.0043		
South Australia	-0.0021	-0.0049		
Western Australia	-0.0010	-0.0151		
Tasmania	-0.0015	-0.0065		
Northern Territory	0.0014	-0.0001		

The main factors that have contributed to the explained component of the educational attainment difference are individual ability, the parents' educational attainments, family size, wealth and attendance at Catholic and other Independent schools. The negative value associated with the ability variable will reflect in large part the change in the measurement of ability discussed above. It is therefore not of concern. The positive value for the parents' educational attainments reflects the growth in the educational attainments of parents over time. This result demonstrates the importance of the inheritance of attributes such as education that will have such a pronounced impact on the individual's success in later life. The positive values of the explained component for the school types variables follow from the relative growth in enrolments at Catholic and other Independent schools over the decade.

For the unexplained component, there are two main findings. First, there is a large positive value associated with the intercepts in the model. This shows that there has been a sharp rise in educational attainments for reasons that are not taken into account by the model. As noted earlier, more favourable societal attitudes towards schooling is one

possibility. The introduction of government policies favouring school retention is another. The intercept will also capture the changes over time in the way some variables are measured. Of prime importance here will be the measurement of ability at an earlier stage in the school career. This change has resulted in the mean of the measure of ability being about four points lower for the 1970 cohort than it was for the 1961 cohort, a drop in value that will be associated with an upward shift in the intercept term for the 1970 cohort. Second, the individual's ability, father's occupational status and the number of siblings have sizeable negative effects on the difference in the mean levels of educational attainments of the two groups. As the ability and occupational status variables have positive impacts on the level of schooling attained, the negative effects in Table 6 indicate a diminution of the influence on educational attainments over time. However, as the number of siblings is associated with lower levels of schooling, the negative effect in Table 6 indicates a strengthening of the influence of this variable.

The decomposition of the change in the year 12 completion rate (final two columns in the Table) is broadly consistent with the aggregate information listed for the decomposition of the changes in the mean levels of education. Specifically, over the decade under review, the year 12 completion rate increased by 15 percentage points, from 48 per cent to 63 per cent. Changes in the values of the characteristics entered into the model of year 12 completion are actually associated with a tendency for year 12 completion rates to be lower for the 1970 cohort than for the 1961 cohort. These changes partly offset the 17 percentage point increase in the year 12 completion rate that is associated with unexplained changes in the way the characteristics used in the model are linked to educational attainment.

Hence, the main findings from these analyses are as follows. First, the models of educational attainment are moderately successful at explaining educational attainment and year 12 completion rates at a point in time. These models are static, and as such capture the circumstances that prevail at one point in time. Many of the measurable factors that impact on educational attainment will evolve slowly over time (e.g., ability, family size). Hence, little of the change in schooling levels or year 12 completion rates between the 1961 and 1970 cohorts should be directly attributable to changes in values of the characteristics that are used to account for variations in educational attainments. Second, when searching for explanation for the pronounced changes in educational attainments that have occurred over the time period under review, institutional and societal factors that may impact on the coefficients in the model may need to be explored. As part of this exploration it may be of interest to see whether the analyses of changes in the educational attainments of females differ from similar analyses undertaken for males. That is, there may be a gender-specific component to the "unexplained" factors that have been highlighted in the study of the schooling data aggregated across males and females. This gender-specific component could be associated with the Equal Pay decisions and Equal Opportunity legislation outlined in Section 1.

6. GENDER DIFFERENCES IN EDUCATIONAL ATTAINMENT

The descriptive analyses presented in Section 2 show that there have been pronounced differences in the changes in the school participation of males and females since 1960. Between 1960 and 1977 the school participation rate of teenage males exceeded the school participation rate of teenage females. Since 1977 the school participation rate of teenage females has exceeded that of males. The multivariate analyses conducted for the 1961 and 1970 cohorts (which would have been making their school leaving decisions during the mid-to-late 1970s and mid 1980s respectively) show that, when the factors that affect school leaving decisions and which can be easily measured are held constant, females have higher educational attainments than males.

In this section the factors contributing to the differences in the educational attainment of males and females from the 1961 and 1970 cohorts will be analysed in greater detail. First, differences between male and female educational attainment for the 1961 cohort will be discussed.[26] Second, a review of the gender differences in educational decisions for the 1970 cohort will be presented. Finally, changes in the gender differential in educational attainment over time will be examined. The discussion focuses mainly on the weighted least squares and ordered probability models.[27]

Table 7 presents the weighted least squares estimates of the model of educational attainment for males and females from the 1961 cohort.[28] For this cohort, the factors that have significant impacts on the educational attainment of both males and females are individual ability, having a non-English speaking parent, the father's occupational status, the father's education, school types and attending schools in non-metropolitan areas. The impact of these variables on educational attainment is similar to that discussed for the pooled analyses reported above. Accordingly, the general patterns in the data will not be discussed.

It will also be apparent from Table 7 that while many of the point estimates in the schooling models for males and females differ (for example, the significant coefficient on the 'non-English speaking parents' variable for males is twice as large as that for females), few of the differences are statistically significant. The exceptions are the variables for non-English speaking parents, the number of siblings and several of the State effects. For example, having a sibling significantly reduces the educational attainment of males but does not affect the schooling of females. This differs from the results reported by Miller and Volker (1989) where a larger number of siblings reduces the educational attainment of both males and females.

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[26] The means and standard deviations of the variables used are presented in Appendix 3.

[27] Logit analyses of completion of year 12 for males and females were also undertaken and the results can be obtained from the authors. These results are used in some decompositions reported in this section.

[28] A Chow test was undertaken to assess whether the slope coefficients in the models of educational attainment are the same for males and females. The computed F value of 3.14 (critical value of 1.45 at the 10 percent level of significance) suggests that the gender differences in educational attainment between males and females cannot be represented adequately using only an intercept shift variable.

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Table 7 WLS Estimates of Schooling Level—1961 Cohort, Males and Females

	Males		Females	
Variable	***Coefficient***	***t-ratio***	***Coefficient***	***t-ratio***
Intercept	1.980	9.27	1.551	6.56
Personal characteristics				
Individual ability	0.046	15.00	0.052	14.06
Non-English speaking parents*	0.394	5.61	0.157	2.31
Youth born in non-English speaking country	0.029	0.25	0.192	1.46
Socioeconomic background				
Father's occupational status	0.008	5.83	0.005	3.51
Father's post-secondary qualification	0.218	3.12	0.230	3.10
Mother's post-secondary qualification	-0.057	-0.68	0.083	1.25
Number of siblings*	-0.049	-3.28	-0.012	-0.89
Wealth	0.029	1.22	0.024	0.96
Schooling origins				
Catholic schools	0.247	3.75	0.281	4.07
Other independent schools	0.210	2.84	0.156	2.05
Schools in non-metropolitan areas	-0.126	-2.39	-0.103	-1.96
ACT	0.260	1.45	0.507	2.91
Victoria*	-0.023	-0.39	0.348	5.71
Queensland*	0.015	0.21	0.230	2.93
South Australia*	0.120	1.56	0.422	5.54
Western Australia*	-0.038	-0.40	0.255	2.98
Tasmania	-0.225	-1.53	0.078	0.56
Northern Territory	0.168	0.24	0.410	0.79
F(18, 1 321)	*27.97*			
F(18, 1 413)			*26.19*	
Adjusted R^2	*0.27*		*0.24*	
Sample size	*1 340*		*1 432*	

Note: The t-ratios are formed using heteroscedasticity-consistent standard errors (see White 1980).

The * denotes an estimated impact that differs significantly (at the 10 per cent level or higher) between males and females.

Table 8 WLS Estimates of Schooling Level—1970 Cohort, Males and Females

	Males		Females	
Variable	***Coefficient***	***t-ratio***	***Coefficient***	***t-ratio***
Intercept	9.812	9.13	10.005	11.99
Personal characteristics				
Individual ability	0.041	7.96	0.038	8.76
Non-English speaking parents	0.160	1.98	0.166	2.49
Youth born in non-English speaking country	0.377	2.43	0.157	1.17
Socioeconomic background				
Father's occupational status	0.002	1.08	0.001	0.83
Father's post-secondary qualification	0.037	0.50	0.182	3.00
Mother's post-secondary qualification	0.057	0.76	0.173	2.96
Number of siblings*	-0.079	-3.27	-0.025	-1.16
Wealth	0.049	1.78	0.005	0.23
Schooling origins				
Catholic schools	0.200	2.69	0.307	4.87
Other independent schools	0.490	6.18	0.371	6.21
Schools in non-metropolitan areas	-0.025	-0.34	0.016	0.26
ACT	0.196	0.90	0.267	1.93
Victoria	0.017	0.21	0.153	2.34
Queensland	0.058	0.61	0.152	1.79
South Australia	0.215	1.95	0.239	2.48
Western Australia	-0.063	-0.53	-0.083	-0.85
Tasmania	-0.229	-1.38	-0.308	-2.00
Northern Territory	0.234	0.80	0.191	0.681
F(18, 769)	*10.55*			
F(18, 906)			*16.13*	
Adjusted R^2	*0.18*		*0.23*	
Sample size	*788*		*925*	

Note: The t-ratios are formed using heteroscedasticity-consistent standard errors (see White 1980). The * denotes an estimated impact that differs significantly (at the 10 per cent level or higher) between males and females.

Table 8 presents the results for the 1970 cohort.[29] Again it is to be noted that while there are some quite considerable differences between the point estimates for males and

[29] A Chow test was undertaken to assess whether the slope coefficients in the models of educational attainment are the same for males and females. The computed F value of 0.69 (critical value of 1.45 at the 10 percent level of significance) suggests that the gender differences in educational attainment between males and females can be represented adequately using only an intercept shift variable. However, separate analyses for males and females are presented for comparison with the analyses undertaken for the 1961 cohort.

females, only one of these differences is statistically significant. As with the Table 7 results for the 1961 cohort, the number of children variable is significant in the equation estimated for males but it is insignificant in the equation estimated for females.

A comparison of the results for the 1961 and 1970 cohorts between males and females reveals several differences. First, individual ability has become less important to female educational attainment while its impact has remained relatively unchanged for males. This may be a flow-on effect from the growth in school participation rates (of around 10 percentage points) over the decade between when the two cohorts would have been teenagers: as schooling becomes more universal it is expected that there would be a weakening of the influence of the ability variable that seems to have played a key sorting role in the 1960s.

Second, the impact of the father's occupational status on schooling has declined over the period under review for both males and females. This result differs from Le and Miller (2001) who report a strengthening of the relationship between the father's occupational status and the educational attainment of daughters across cohorts. The reason for this difference is not clear.[30]

Third, the mother's educational attainment does not affect the schooling level of their sons in either cohort. In comparison, the mother's qualifications have become relatively more important as determinants of schooling for daughters. These results are consistent with Le and Miller (2001) and suggest a strengthening of the influence of the mother as a role model for daughters (but not for sons).

Finally, while the relationship between enrolment at an Independent school and educational attainment strengthened among both males and females, the influence of enrolment at a Catholic school has declined slightly over the decade for males but has strengthened for females.

An alternative approach to compare the difference in male/female educational attainment over time is to look at their success at reaching different schooling levels. The ordered probit results for the 1961 cohort are presented in Table 9. Overall, the results for this cohort are very similar to those obtained from the weighted least squares model. Thus, differences in the probability of completing a particular schooling level between males and females are primarily due to the individual's ability, the parents' birthplace, the father's occupational status, family size and several of the State effects (the effects of these variables differ significantly between males and females). The remaining differences, while contributing to gender differences in overall educational attainment, are not statistically significant at conventional levels of significance.

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[30] Le and Miller (2001) examine a wider spectrum of cohorts in their analysis, the youngest of which would have made their schooling leaving decisions before the 1970 cohort in the current analysis made their decisions. Extension of the approach taken in the current paper to younger cohorts may therefore have merit.

Table 9 Ordered Probit Estimates of Model of Education Levels—1961 Cohort, Males and Females

	Males		Females	
Variable	***Coefficient***	***t-ratio***	***Coefficient***	***t-ratio***
Intercept	-1.910	-7.05	-2.606	-10.11
Personal characteristics				
Individual ability*	0.059	14.76	0.068	17.15
Non-English speaking parents*	0.580	7.05	0.243	3.13
Youth born in non-English speaking country	0.087	0.64	0.251	1.59
Socioeconomic background				
Father's occupational status*	0.013	7.49	0.007	4.58
Father's post-secondary qualification	0.431	4.41	0.372	4.05
Mother's post-secondary qualification	-0.095	-0.79	0.173	1.46
Number of siblings*	-0.061	-5.86	-0.007	-0.54
Wealth	0.039	1.33	0.034	1.12
Schooling origins				
Catholic schools	0.391	5.65	0.406	4.74
Other independent schools	0.371	3.06	0.367	2.44
Schools in non-metropolitan areas	-0.167	-2.99	-0.128	-2.35
ACT	0.490	0.71	0.830	1.33
Victoria*	-0.069	-1.13	0.425	6.91
Queensland*	0.036	0.38	0.312	3.63
South Australia*	0.087	0.65	0.505	3.57
Western Australia*	-0.069	-0.43	0.330	2.21
Tasmania	-0.322	-0.88	0.108	0.30
Northern Territory	0.162	0.07	0.463	0.20
μ_2 (a)	1.679	28.79	1.601	30.79
μ_3	2.230	36.31	2.080	38.77
χ^2 *(18)*	*445.64*		*340.12*	
McFadden R^2 (b)	*0.14*		*0.11*	
Sample size	*1340*		*1 432*	

Note: (a) The $\hat{\mu}$ s are estimates of the separation points that appear in equation (1.2).

(b) The McFadden R^2 is calculated as $1 - (l_m/l_o)$, where l_m = the maximised log-likelihood value of the model and l_o = the log-likelihood value if the non-intercept coefficients are restricted to zero (see Veall & Zimmermann 1996).

The * denotes an estimated impact that differs significantly (at the 10 per cent level or higher) between males and females.

The ordered probit results for the 1970 cohort reported in Table 10 are broadly consistent with those reported for the 1961 cohort. However, there are several differences between the estimates obtained for the younger cohort and those obtained for the older cohort that may be noted. First, the impact of individual ability on schooling has decreased more for females than for males over the period under review. It was argued earlier that the decline in the measured impact of the ability variable in these analyses was largely due to

a change in the way ability was being measured in the *Youth in Transition* surveys. However, this change in measurement should not impact more on females than on males. Hence, the larger decrease in the impact of the ability variable must have an explanation elsewhere: the reduced sorting of students by ability as school participation rates grow that was advanced earlier is a prime candidate in this regard.

Table 10 Ordered Probit Estimates of Model of Education Levels—1970 Cohort, Males and Females

	Males		Females	
Variable	***Coefficient***	***t-ratio***	***Coefficient***	***t-ratio***
Intercept	-1.012	-3.54	-0.987	-3.36
Personal characteristics				
Individual ability	0.051	12.23	0.051	10.22
Non-English speaking parents	0.181	1.86	0.307	2.97
Youth born in non-English speaking country	1.144	0.94	0.421	1.42
Socioeconomic background				
Father's occupational status	0.003	1.45	0.004	1.54
Father's post-secondary qualification*	0.087	0.98	0.377	3.75
Mother's post-secondary qualification	0.088	0.89	0.285	2.54
Number of siblings*	-0.112	-5.06	-0.038	-1.71
Wealth	0.069	2.05	0.018	0.62
Schooling origins				
Catholic schools	0.297	2.88	0.493	4.92
Other independent schools	1.065	5.37	0.908	4.38
Schools in non-metropolitan areas	-0.006	-0.09	0.034	0.44
ACT	0.391	0.49	0.530	1.15
Victoria*	-0.057	-0.61	0.161	1.92
Queensland	0.074	0.76	0.231	2.05
South Australia	0.238	1.08	0.277	1.46
Western Australia	-0.073	-0.41	-0.144	-0.71
Tasmania	-0.303	-0.92	-0.437	-1.42
Northern Territory	0.273	0.19	0.111	0.11
μ_2 (a)	1.450	17.95	1.491	18.20
μ_3	1.847	22.23	1.943	22.91
χ^2 (18)	*170.22*		*277.93*	
McFadden R^2 (b)	*0.11*		*0.16*	
Sample size	*788*		*925*	

Note: (a) The $\hat{\mu}$ s are estimates of the separation points that appear in equation (1.2).

(b) The McFadden R^2 is calculated as $1 - (l_m/l_o)$, where l_m = the maximised log-likelihood value of the model and l_o = the log-likelihood value if the non-intercept coefficients are restricted to zero (see Veall & Zimmermann 1996).

The * denotes an estimated impact that differs significantly (at the 10 per cent level or higher) between males and females.

Second, there are a number of differences over time with regard to the impacts of family variables on the educational attainment of males and females. For example, the effect of the father's occupational status on both sons' and daughters' probability of completing a particular schooling level has diminished (and has actually become insignificant) over time. In addition, the impact of the father's educational attainment on the son's schooling has lessened quite dramatically over time. In comparison, the impacts of the father's educational attainment on the daughter's chances of finishing year 12 or of being an early school leaver have remained fairly constant. The association between the mother's education and the daughter's schooling is stronger for the younger cohort than it is for the older cohort. This variable is insignificant in the analyses of the education levels of males in both the 1961 and 1970 cohorts.

The effect of the number of siblings has strengthened over time in the models of education levels for both males and females. A larger number of siblings decreases the probability of finishing year 12 and increases the probability of leaving school early. This impact is more pronounced for males than it is for females. The changes over time in the coefficients on the family wealth variable may also be noted. Whereas this variable was statistically insignificant in the estimates for both males and females for the 1961 cohort, it has a significant effect for males in the analysis of education levels for the 1970 cohort.

Finally, with regard to schooling origins, a number of features can be noted. First, the advantage Catholic schools have over government schools in affecting retention rates has declined for males but not for females. In comparison, there has been an increase in the gap between other Independent and government schools in terms of the effects they have on retention rates, and the widening of this gap is reasonably similar for both males and females. This may reflect a widening of differences in teaching methods, quality of teachers or investment in technology and facility between government and other Independent schools over time.[31]

Overall, the above results suggest that females in the late 1980s rely more heavily on their parents' influence in order to succeed at school than males. Family wealth appears not to be important to the educational attainment of females. Williams (1987) suggest that this may be because parents are less willing to invest economically in the education of daughters. Finally, the advantage in terms of school retention associated with enrolment in non-government schools for females has increased over time.

One of the ways of summarising the above results is to decompose the changes over time in male and female year 12 completion rates into a component due to changes in the characteristics included in the model and into a component that is unexplained by the model, being associated with changes in the estimated coefficients. As noted above, the changes in estimated coefficients are presumably associated with changes in attitudes towards education and institutional changes.

For males, the year 12 completion rate for the 1970 cohort is 13.4 percentage points higher than the 12 year completion rate for the 1961 cohort. When this change is analysed using the Farber decomposition (see Appendix 4), there is a small negative

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[31] Recall also the change between the 1961 and 1970 cohorts in the way the school system variable is defined.

'explained' component (4.1 percentage points) and a large positive 'unexplained' component (17.6 percentage points). For females, the year 12 completion rate for the 1970 cohort is 16.1 percentage points higher than the year 12 completion rate for the 1961 cohort. This change can be decomposed into a small negative 'explained' component (1.3 percentage points) and a large positive 'unexplained' component (17.3 percentage points).

These decompositions suggest that the changes in school participation rates during the late 1970s and 1980s have been due to factors that have a reasonably neutral impact on males and females. The more detailed decompositions presented in the following section allow this issue to be explored further.

Decomposition Results

In this section the gender differences in educational attainment across cohorts will be discussed in greater detail. As outlined in Section 4, two approaches to addressing the issue of cohort effects can be undertaken. The results using Wellington's (1993) decomposition will be presented first. Then the results from the decomposition showing the links between gender and other characteristics in the educational attainment model will be discussed.

Table 11 presents the decomposition of the differential change in educational attainment between males and females from 1961 to 1970. The first two columns of figures are for the decomposition of the differential in the growth in male and female mean levels of education, as outlined in equation 2.4 of Appendix 2. The final two columns of figures provide a similar decomposition of the differential growth in male and female year 12 completion rates. This extension of the Farber (1990) decomposition is outlined in Appendix 4.

Column two of Table 11 shows differences in educational attainment due to differences in the characteristics of males and females across cohorts. Column three shows gender differences in educational attainment that are associated with behavioural changes over the period under review that have a differential impact on male and female educational attainments. A negative sign in each case implies an increase in females' mean level of education compared to that of males.

A number of features from the first two columns of figures in Table 11 can be noted. First, the change in the gender difference in educational attainment between 1961 and 1970 is -0.088. This very small negative amount implies that while both male and female schooling levels have increased over the period under review, they have done so at very much the same rate, with the mean female level of schooling increasing only slightly faster than the mean male level of schooling. Second, when the focus is upon the total explained and unexplained components, the slight increase in female educational attainment relative to that of males is seen to be due almost entirely to differential rates of change in the characteristics of males and females. The component of the change in educational attainments in Table 11 due to changes in coefficients is very small. While, as noted in Section 5, changes in coefficients are very important to the explanation of the growth in education levels and year 12 completion rates over time when analyses are conducted separately for males and females, these have a reasonably neutral impact on the schooling decisions of males and females.

Table 11 Decomposition of the Change in Educational Attainment between Males and Females, 1961–1970

	Levels of Education		Year 12 Completion Rate	
Variable	*Explained*	*Unexplained*	*Explained*	*Unexplained*
Total Educational Difference	*-0.0880*		*-2.641*	
Total Explained	*-0.0852*			-2.863
Total Unexplained		*-0.0028*		*0.236*
Intercept	—	-0.6222		
Individual ability	-0.0481	0.4864		
Non-English speaking parents	-0.0028	-0.0435		
Youth born in non-English speaking country	-0.0115	0.0172		
Father's occupational status	-0.0028	-0.0845		
Father's post-secondary qualification	-0.0209	-0.0219		
Mother's post-secondary qualification	-0.0179	-0.0001		
Number of siblings	0.0233	-0.0512		
Wealth	0.0158	0.1723		
Catholic schools	-0.0218	-0.0122		
Other independent schools	0.0039	0.0072		
Schools in non-metropolitan areas	0.0025	-0.0047		
ACT	-0.0020	0.0026		
Victoria	-0.0033	0.0649		
Queensland	0.0033	0.0172		
South Australia	-0.0026	0.0286		
Western Australia	-0.0009	0.0283		
Tasmania	0.0004	0.0124		
Northern Territory	0.0001	0.0004		

Focusing on the results in column two, it can be seen that individual ability has the largest impact on the explained component of the growth in the educational attainments of males and females that can be analysed with Wellington's decomposition. The negative sign on this coefficient suggests that the changes in measured ability over the decade under review have reduced the male educational advantage or increased any female educational advantage. While the measurement issues associated with this variable have been highlighted earlier, in the current decomposition changes for females across cohorts are being compared to changes for males across cohorts. This will tend to 'normalize' the ability measure and hence negate the influence of the measurement changes. However, it will be evident from the decomposition outlined in Appendix 2 that even where the change in the mean values of a characteristic is the same for males and females, given that the changes for males (females) are weighted by coefficients from the models of educational attainment for males (females), if a characteristic has a different impact on educational attainments for males than for females, it can still impact on the magnitude of the overall differential attributed to changes in means.[32]

[32] This is a feature of the Wellington (1993) decomposition which does not appear to have caused concern among practitioners. The decomposition advanced by Smith and Welch (1989) overcomes this problem, albeit at the cost of involving additional interaction terms. For simplicity the Wellington (1993) decomposition will be used in this study. The Wellington (1993) decomposition has been used in several recent studies of gender wage effects in Australia: see, for example, Preston (1997, 2001) and Kidd and Meng (1995).

Other variables that play some role in explaining differences in gender educational attainments between 1961 and 1970 include parents' education, family size, wealth and attendance at Catholic schools. The changes in family size and wealth have increased the schooling gap between males and females, while the changes in parents' education and attendance rates at Catholic schools have reduced this gap over time. The results for family size and wealth may seem surprising, given that the changes in these characteristics for males and females across cohorts should be reasonably similar. However, inspection of Table 8 shows that both variables have different impacts in the models estimated for males and females, which, as noted above, can also impact on the 'changes due to means' (again, see equation 2.4 in Appendix 2).

With regard to the results listed in column three, the total unexplained component of the differential rates of growth in the educational attainments of males and females between 1961 and 1970 can be largely attributed to changes in the following coefficients: individual ability, the father's occupational status, family size and wealth. The figures for the intercept term and ability variable are both quite large, and essentially offset each other. The intercept term suggests that, relative to the situation for males, there has been growth in female educational attainment of almost two-thirds of a year between the 1961 and 1970 cohorts. But the result for the ability variable suggests that there has been a relative weakening of the relationship between educational attainment and ability for females, which has led to males maintaining their relative educational attainment situation.[33] This could mean that the greater female participation in secondary education recorded in Figure 1 has been achieved by attracting relatively more females of average or below average ability to stay longer at secondary school. This might be associated with changes in the entry requirements for some occupations (see, for example, Saha 1982 and Williams et al. 1993b) impacting on the desired level of education for the 1970 cohort in a way that differs by the level of ability. It is noted that Williams et al. (1993a) also document a change in the representation of students in the various achievement quartiles used in their analysis. The share of year 12 graduates coming from the highest achievement quartile has declined over time, and the shares of the lowest achievement quartile, and particularly that of the second lowest quartile, have increased over time. The current set of analyses suggests that these changes are stronger for females than for males.[34]

The final two columns of Table 11 present the results of our generalisation of the Farber (1990) decomposition of different rates of growth in male and female year 12 completion rates. These results for year 12 completion rates reinforce the finding derived from the decomposition of the changes between 1961 and 1970 in the difference in mean educational attainments of males and females. In summary, females have widened their

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[33] As noted earlier, the ability or achievement variable is measured at different ages for the 1961 and 1970 cohorts (at age 14 for the 1961 cohort and at age 10 for the 1970 cohort). Inspection of the decomposition outlined in Appendix 2 reveals that this should not have a major impact on the results, as the differences across cohorts are not examined in an absolute sense: rather the differences for males are compared to those for females.

[34] Long et al. (1999 p.113) reported that the proportion of high achievers reaching year 12 is considerably higher in the 1970 cohort than in the 1961 cohort. This would be consistent with the statement on shares in the text if the growth in year 12 graduation rates among low achievers was in excess of that for higher achievers. Long et al. (1999), for example, showed that the growth in year 12 completion rate among the low achievers (those in the lowest 25 percent quartile) during the 1990s has been relatively higher than that for higher achievers.

advantage over males in terms of both year 12 completion rates and mean levels of schooling, and the greater part of this widening of the female educational attainment advantage is due to changes in the values of characteristics of males and females. Very little of the change arises due to changes in the coefficients in the models of educational attainment that might favour females over males (or vice versa). In other words, the general changes that were suggested in Section 1 as leading to change in coefficients in the models of educational attainment (e.g., changes in social attitudes towards schooling, changes in the labour market) have had a reasonably neutral impact on the educational attainments of males and females. We return to this issue in the concluding section.

The Table 12 decomposition results are obtained using equation 6 from Section 4. These show why the estimated impact of the gender variable in a multiple regression with the level of education as the dependent variable differs from that obtained in a simple regression (which will record the difference between the mean educational attainments of males and females listed in Tables 3.2 and 3.3 of Appendix 3). The effects listed in Table 12 depend on the estimated impact of each characteristic in the multiple regression model of educational attainment, and on the links between gender and each of the characteristics. For the 1961 cohort, the results show that the difference between the gender effects estimated in multiple and simple regressions is relatively modest, at 0.032. The positive value indicates that the gender effect is slightly greater in the multiple regression than in a simple regression of educational attainment on the dichotomous female dummy variable. This difference for the 1961 cohort is largely due the father's occupational status, family size and Catholic school system.

Consider the value of 0.0116 for the father's occupational status for the 1961 cohort. Father's occupational status has a positive effect on educational attainments in Table 1. There is a negative bivariate relationship between father's occupational status and the dichotomous female dummy variable (compare also the means for the father's occupational status variable in Tables 3.2 and 3.3 of Appendix 3). Hence $-\beta_{occup} b_{occup,\,female}$, where 'occup' denotes the father's occupational status variable, is positive. As a result, controlling for the father's occupational status in a multiple regression context will enhance the estimated gender (female) effect on educational attainments.

Consider the value of -0.0043 for the number of siblings variable. The number of siblings has a negative effect on educational attainments in Table 1. There is a negative bivariate relationship between the number of siblings and the female dummy variable (again, compare the means for the number of siblings variable in Tables 3.2 and 3.3 of Appendix 3). Hence $-\beta_{siblings} b_{siblings,\,female}$ is negative. As a result, controlling for the number of siblings in a multiple regression model of educational attainment will reduce the estimated gender effect on educational attainments.

Table 12 Decomposition of the Influences of Variables on the Gender Educational Difference

	1961 Cohort	1970 Cohort
Difference between impacts estimated in multiple and simple regressions	0.0321	-0.0574
Derives from		
Individual ability	0.0030	-0.0366
Non-English speaking parents	0.0004	-0.0024
Youth born in non-English speaking country	0.0015	-0.0034
Father's occupational status	0.0116	0.00007
Father's post-secondary qualification	0.0007	0.0019
Mother's post-secondary qualification	-0.0005	-0.0027
Number of siblings	-0.0043	-0.0107
Wealth	0.0006	-0.0012
Catholic schools	0.0154	-0.0029
Other independent schools	0.0018	0.0042
Schools in non-metropolitan areas	-0.0028	-0.0003
A.C.T.	-0.0005	-0.0021
Victoria	0.0041	-0.0047
Queensland	0.0005	0.0048
South Australia	0.0022	-0.0010
Western Australia	-0.0015	-0.0002
Tasmania	0.00002	0.00004
Northern Territory	-0.0001	-0.0002

For the 1970 cohort, the gender difference between the impacts estimated in multiple and simple regressions is -0.057. The negative value here shows that the gender effect is smaller in the multiple regression than it is in a simple regression of educational attainment on the dichotomous female dummy variable. This difference is mainly associated with individual ability and family size. It should be noted that controlling for both ability and family size reduces the estimated gender differential in schooling.

An across cohort comparison reveals a number of important changes in the links between gender and the determinants of educational attainment which alter the gender schooling differential over time. In particular, individual ability, non-English speaking parents, youth born in a non-English speaking family, mother's educational attainment and number of siblings have become relatively more important contributors to the higher mean levels of education observed among females compared to males. The diminution of the effect of the father's occupational status between the 1961 and 1970 cohorts will have a similar impact.

As noted above, the terms in Table 12 record $\beta_k b_{k_female}$, where 'k' is the k^{th} regressor. The b_{k_female} correlation will affect the differences in the mean values of characteristics which were identified in the Wellington (1993) decomposition as being important to an understanding of why female educational attainments have increased relative to those of males. Hence, the results of both of the decompositions presented in this Section identify family background factors as being important to the change in the gender differential in educational attainments during the late 1970s to mid-to-late 1980s. While the changes identified are small, the period analysed is short. Larger changes might be expected where a period as long as the four decades reviewed in the descriptive analyses in Section 2 were covered.

7. CONCLUSION

The level of schooling an individual completes will have a major bearing on his or her success in later life. Despite the volume of evidence linking educational attainment and favourable labour market outcomes, many students continue to leave school without completing year 12. This study shows that the major factors affecting school leaving decisions are ability, school type and, to a lesser extent, family background. The measured effects of the dimensions of family background included in the analysis appear to have changed considerably over the period of the late 1970s to late 1980s when the 1961 and 1970 cohorts analysed would have made their school leaving decisions.

The analyses show that the increase in the educational attainment of males between the 1961 and 1970 cohorts is due to factors that have caused the coefficients that link individual characteristics to educational attainment to change. The same conclusion is drawn when the increase in female educational attainment between the 1961 and 1970 cohorts is examined. However, when the differential changes over time in the educational attainments (either mean level of education or year 12 completion rates) of males and females are examined, the excess growth in female educational attainment over that of their male counterparts is shown to derive from changes in the values of the characteristics possessed by males and females. Relatively little of the widening of the advantage of females in educational attainment between the 1961 and 1970 cohorts is attributable to different changes in the estimated coefficients in the models of educational attainments. In other words, the factors that are associated with the reasonably major changes in the coefficients in the models of educational attainment estimated for males and females have had a neutral impact on the school leaving behaviour of males and females.

This finding may seem surprising given that one set of institutional and labour market changes that should affect the cohort analysis had, by design, a different impact on males and females. The major changes in the labour market during the 1970s and 1980s, specifically the Equal Pay for Equal Work decision of 1969 (to be implemented by 1972), the Equal Pay for Work of Equal Value decision of 1972 and the Sex Discrimination Act of 1984 increased women's status in the labour market relative to that of men. These major changes do not, however, appear to have had any differential effect in the model of educational attainment estimated for females compared to that estimated for males. The main reason for this is presumably that female schooling decisions are made on the basis of within-gender comparison of the advantages associated with higher

levels of education. Between-gender differences in labour market outcomes or indeed social outcomes do not appear to affect these decisions. This issue is explored in detail in Appendix 5.

The findings reported in this study suggest that, in terms of cohort analysis, further attention in research needs to be devoted to the time periods covered, so that the cohort analysis can overlap the much wider period covered in typical cross-sectional studies such as Le and Miller (2001). Attention also needs to be devoted to the role of the father's occupational status and the educational attainments of both the mother and father (see Table 11). The role of these dimensions of family background in affecting decisions other than the school leaving decision should also be investigated. Included here are the associations between family background and the type of school attended. Such analysis would provide understanding of some of the important changes documented in this study and referred to simply as 'changes in means'.

The analyses show that labour market reforms that have a focus on females per se are not likely to have a major impact on female schooling decisions. However, any increases in the income and other advantages associated with higher education among females may have an influence. It is also evident that school type has a considerable bearing on school leaving decisions. The reasons for this are in need of examination. Moreover, the importance of ability in comparison to family background factors in contributing to differences in educational attainment is consistent with other research in this area using different data sets and analytical techniques (e.g., Miller, Mulvey & Martin 2001). In the context of the decompositions advanced in this study, as changes in the ability variable are generally considered to be outside the scope of education policy, changes in educational attainment might arise only through changes in the way individuals of different levels of ability make decisions. To this end the curriculum in or advantages offered by the various levels of education may need to be the focus in order to achieve the change in coefficients shown by the decomposition analyses as being needed to have a major influence on educational attainments.

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Appendix 1: Ordered Probit Model of Participation in Education

The ordered probit approach to the modelling of educational outcomes can be motivated as follows. Define an education variable $E_i = 1,2,.....,K$ where $E_i = 1$ if the individual reaches a particular threshold level of schooling, $E_i = 2$ if the individual reaches another, higher, threshold level of schooling and $E_i = K$ if the individual reaches the K^{th} threshold level of schooling. Attainment of one of the K threshold levels of educational attainment can be determined with reference to the underlying ordering of schooling level given by E_i^* by defining a set of threshold levels or separation points,

$$\mu_1 < \mu_2 < ..... < \mu_{K-1}.$$

These threshold levels can be used to establish the following well-defined order

$$\begin{aligned} E_i &= 1 \quad if \quad E_i^* < \mu_1 \\ E_i &= 2 \quad if \quad \mu_1 < E_i^* < \mu_2 \\ E_i &= K-1 \quad if \quad \mu_{K-2} \le E_i^* < \mu_{K-1} \\ E_i &= K \quad if \quad \mu_{K-1} < E_i^* \end{aligned} \tag{1.1}$$

That is, an individual will be in the lowest schooling attainment (education category one) where their value of the E_i^* index falls short of the first threshold level (μ_1). Individuals with a value of the E_i^* index greater than the first threshold will be in a higher-ranked schooling attainment, with the actual schooling level being determined by a comparison of their E_i^* index with the separation points as set out above. Those individuals with the highest level of the schooling index will be in the highest ranked level of education (E_i=K).

Given the assumption that the ordering is embedded within a probit model, the conditional probability that individual i will be located in schooling attainment j ($P_{ij}|X_i$) is given as

$$P_{ij}|X_i = \Phi(\mu_j - X_i\delta) - \Phi(\mu_{j-1} - X_i\delta) \qquad j=1,.....,K \tag{1.2}$$

where X is the vector of characteristics of individual i described above, the δs are sets of weights that link the schooling index to the characteristics contained in X, the μs are the separation points on the scale which partition membership of various schooling levels, and Φ is the cumulative density function of the standard normal distribution.

Appendix 2: Changes in Educational Attainment Over Time: Decomposition Analysis

When addressing the issue of cohort effects, the model outlined in the text is extended as follows:

$$E_{m,t} = X_{m,t}\beta_{m,t} + \varepsilon_{m,t} \tag{2.1}$$

$$E_{f,t} = X_{f,t}\beta_{f,t} + \varepsilon_{f,t}. \tag{2.2}$$

Here t refers to the year of study. For example, educational attainment for two years (defined by either the year of survey or cohort of birth) such as 1961 and 1970 might be studied. In this case there are two ways to proceed.

First, the enquiry might be directed to understanding why female educational attainment has changed over time, or why male educational attainment has changed over time. In this case, the equation estimated above can be used to decompose the changes over time in the mean educational attainment within a gender group as follows:

$$\left(\overline{E}_{g,70} - \overline{E}_{g,61}\right) = \left(\overline{X}_{g,70} - \overline{X}_{g,61}\right)\hat{\beta}_{g,70} + \overline{X}_{g,61}\left(\hat{\beta}_{g,70} - \hat{\beta}_{g,61}\right), \qquad \text{g=m,f} \tag{2.3}$$

This decomposition permits the change in the mean educational attainment of either males or females measured on the left-hand side of the equation to be analysed in terms of two components. The first of these captures the impact on the growth in educational attainments of changes over the study period in the mean values of characteristics of the particular gender group. The second component captures the effect of changes over time in the ways that these characteristics are related to educational attainment. Drawing upon the earlier interpretation of this term, it will reflect the impact on the group's educational attainment that is associated with changes in the views of the individual, the family or society towards the educational achievement of the particular group. For example, if social reform over the study period is favourable towards female participation in education then this should be reflected in a positive value for the second component on the right-hand side of equation 2.3.

The second way in which the changes over time in educational attainment may be analysed is to simultaneously consider the time and gender dimensions under review. Wellington's (1993) extension of the conventional one-period approach to two periods may be applied in this instance. This is given as:

$$\left[\left(\overline{E}_{m,70} - \overline{E}_{f,70}\right) - \left(\overline{E}_{m,61} - \overline{E}_{f,61}\right)\right] = \left[\left(\overline{X}_{m,70} - \overline{X}_{m,61}\right)\hat{\beta}_{m,70} - \left(\overline{X}_{f,70} - \overline{X}_{f,61}\right)\hat{\beta}_{f,70}\right] + \left[\overline{X}_{m,61}\left(\hat{\beta}_{m,70} - \hat{\beta}_{m,61}\right) - \overline{X}_{f,61}\left(\hat{\beta}_{f,70} - \hat{\beta}_{f,61}\right)\right]. \tag{2.4}$$

Here the term on the left-hand side measure the change in the difference in the mean educational attainments of males and females over the period under review (say 1961 and 1970). The term in the square brackets on the right-hand side measures the portion of this change that can be linked to changes in the characteristics of males and females (e.g., the average measured ability of females increasing relative to that of males). The second term in square brackets on the right-hand side of the above expression measures the

portion of the changes in the mean educational attainments of males and females that cannot be explained by changes in the mean levels of characteristics of the two groups. This portion of the educational differential will thus record the impact of behavioural changes over the period under review that are advantageous to either males (where the values calculated are positive) or to females (where the values calculated are negative).

A further method that can be employed in the analysis of gender differences in cohort effects stresses the links between gender and the other characteristics that are included in the model of educational attainment. Hence, consider estimating a model of educational attainment where the data are pooled across males and females. In the first instance, consider including in the analysis only a dummy variable (F) for whether the person is a female. Then the equation to be estimated is given as:

$$E_t = \alpha_0 + F_t \alpha_t^c + \varepsilon_t . \tag{2.5}$$

In this simple specification, the constant term α_0 will measure the mean educational attainment of males while α_t^c will be the mean differential between the educational attainments of males and females at time t that is apparent in Figure 1.

Now expand the specification by including other determinants of educational attainment (X) in the estimating equation. The equation to be estimated now is

$$E_t = \alpha_0 + F_t \alpha_t^m + X_t \beta_t + \varepsilon_t . \tag{2.6}$$

In the multivariate specification, α_t^m is the difference between the educational attainments of males and females at time t when other factors (such as family background, school type, measured ability) are held constant.[35] It is the standardised difference between the educational attainments of males and females.

Why does this standardised difference in educational attainments differ from the mean effect observed in the simple regression? This is easily established by noting that:

$$\alpha_t^m - \alpha_t^c = -\sum_{i=1}^{i} \beta_{t,i} b_{t,if} \tag{2.7}$$

where $\beta_{t,i}$ is the estimated partial coefficient of the i^{th} control variable (at time t), and $b_{t,if}$ is the coefficient from a simple regression of the i^{th} control variable on the gender variable (for further information on this approach, see Johnson & Solon 1986; and Chiswick & Miller 1996).[36] This equation can be implemented for various years (e.g., $t = 1961$, $t = 1970$). An across-time comparison of the decomposition of the term $(\alpha_t^m - \alpha_t^c)$ using this approach can show how the various links between gender and other determinants of educational attainment observed in practice (i.e., they are the links estimated using simple regressions) have changed over time to alter the female educational differential that is evident in Figure 1.

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[35] The vector X in this model will not include a constant term.

[36] This approach is implicit in the work reported in Williams et al. (1993a).

Appendix 3: Data and Definitions of Variables

Population

The *Youth in Transition* surveys are used in the analyses presented in this study. The surveys comprise national samples of individuals born in 1961, 1965, 1970 and 1975. This study focuses on individuals who were born in 1961 and 1970. For the 1961 cohort the survey covered the period from 1978 to 1994. This cohort initially had 6,260 persons (Australian Council for Educational Research 2000a). For the 1970 cohort the survey covered the period from 1985 to 1994. This cohort initially had 5,475 persons (Australian Council for Education Research 2000b). Information on four types of variables were collected: (i) Post-secondary education/training (e.g., area of study, institution attended, qualification received); (ii) Employment history (e.g., number of jobs held since leaving school, unemployment duration, weekly income, hours worked); (iii) Other variables (e.g., individual ability, general feeling about life, financial matters); and (iv) Background variables (e.g., age, gender, birthplace, parents' education, family size).

Dependent Variable

Schooling level: This is a continuous variable which measures the different levels of schooling the individual has obtained. The variable takes a value of eight for completion of year seven, nine for completion of year eight, 10 for completion of year nine, 11 for completion of year 10, 12 for completion of year 11 and 13 for completion of year 12. This coding does not attempt to take account of the different approaches to schooling across the States and Territories in relation to the kindergarten year. Rather it focuses on the equivalences of the final years of study generally recognised in Australia. In some presentations, membership in a particular schooling level is ranked in descending order as follows: (i) completed year 12; (ii) completed year 11; (iii) completed year 10; (iv) completed year nine or below. When year 12 completion rates are examined, individuals who completed year 12 are coded as one and individuals who left school prior to year 12 are coded as zero.

Independent Variables

Female: This is a dichotomous variable and is set equal to unity if the individual is female. Males are assigned a value of zero.

Individual ability: This is a continuous variable and measures the combined literacy and numeracy test scores of the individual when he/she was 14 years old (1961 cohort) and 10 years old (1970 cohort).

Non-English speaking parents: This is a dichotomous variable and is set equal to unity if either parent was born in a non-English speaking country.

Youth born in non-English speaking country: This is a dichotomous variable and is set equal to unity if the individual and either parent were born in a non-English speaking country.

Father's occupational status: This is a continuous variable and is coded to the ANU2 scale. The ANU2 scale has values from zero to 100 and it measures the general 'goodness' of a job. The higher the ANU2 score the higher the occupational prestige.

Father's post-secondary qualification: This is a dichotomous variable and is set equal to unity if the father possesses a post-secondary qualification.

Mother's post-secondary qualification: This is a dichotomous variable and is set equal to unity if the mother possesses a post-secondary qualification.

Number of siblings: This is a continuous variable and measures the number of siblings the individual has.

Wealth: In the absence of a direct measure of wealth, a proxy variable, defined as the number of bedrooms and bathrooms in the house, is used.

Type of school: Three categories of the type of school are distinguished, with binary variables being created for: (i) Government schools; (ii) Catholic schools; and (iii) other Independent schools. Government schools are used as the benchmark group in the statistical analyses. For the 1961 cohort the measure of type of school was part of the sample design and the modal year for which the school system information was collected was year nine. For the 1970 cohort the measure of school type refers to the school individuals attended in 1985, and the modal year for this was year 10.

Schools in non-metropolitan areas: This is a dichotomous variable and is set equal to unity if the individual either resides (1970 cohort) or attends a school (1961 cohort) in a non-metropolitan area.

State/Territory attended school: Seven categories of the State in which the individual attended school are distinguished, with binary variables being created for: (i) New South Wales; (ii) Australian Capital Territory; (iii) Victoria; (iv) Queensland; (v) South Australia; (vi) Western Australia; (vii) Tasmania; and (viii) Northern Territory. New South Wales is used as the benchmark group in the analyses.

Some comments on the specification are in order.

• Ethnicity: The specification differs from that in Williams et al. (1993a) in that those born abroad in English-speaking countries are not distinguished from the Australian born. This specification builds on the findings reported in the literature that the distinction between the Australian born and those born abroad in an English-speaking country is not of major importance to the understanding of variations in educational attainment in the population. There is also an attempt to incorporate information on first- and second-generation status into the way the information on the non-English speaking birthplace groups is used.

• Number of siblings: A variable for the number of siblings is included in the model. This is important in many empirical studies of educational attainment (e.g., Miller & Volker 1989) and in theoretical models of quality-quantity trade-offs in fertility decisions (see Becker & Lewis 1973). A similar variable is used by Williams and Carpenter (1990) but Williams et al. (1993a) do not allow for family size effects in their model.

• Parents' occupation: The ANU2 occupational prestige scale for the father's occupation is used as a continuous variable. Williams et al. (1993a, 1993b) use six categories derived from this scale. A linear measure is a convenient simplification that appears to capture the main features of the data reasonably well (see also Williams & Carpenter 1990).

• Parents' education: Following Williams and Carpenter (1990) information on mother's education and father's education is included separately in the model. In comparison, Williams et al. (1993a) use mainly the mother's education. Only variables for possession of post-secondary qualifications are used, as experimentation with the data indicated that these provided a relatively more robust specification.

• Family wealth: Williams et al. (1993a) use the sum of the number of bedrooms, bathrooms, telephones and dishwashers in the house as a proxy for family wealth. The current study uses a subset of these, namely the number of bedrooms and bathrooms. The constructed variable is entered in the model in continuous form. Williams et al. (1993a) group the data into quartiles and distinguish the upper and lower quartiles from the middle 50 per cent of the sample. Given the results reported in the various studies of the *Youth in Transition* data (that the wealth effects are relatively weak), further experimentation of this proxy for family wealth is unlikely to enhance explanation of educational outcomes.

• State/School system/Ability: The model used here follows that specified by Williams et al. (1993a).

• Psychological support: Williams et al. (1993a) incorporate measures of psychological support from self and significant others into their model of educational attainment. 'Parent, teacher and peer expectations were measured as respondent self-reports of the expectations of parents and teachers about what the respondent should do after leaving school, and reports of friends' aspirations'. Self-concept of ability was tapped by responses to the question: 'How good were you at schoolwork compared to other students in your class in your year of secondary school?' (p.71). This set of variables is not used as the information is collected for many respondents on an ex-post basis. The importance of this specification difference is an area for future study.

Table 3.1 Weighted Means and Standard Deviations of Variables—Pooled Sample

	1961 COHORT		1970 COHORT	
Variable	***Mean***	***Std.Dev***	***Mean***	***Std.Dev***
Personal characteristics				
Female	50.00	50.01	53.11	49.92
Individual ability	57.18	7.08	53.64	7.20
Non-English speaking parents (%)	17.76	38.23	21.69	41.23
Youth born in non-English speaking country (%)	4.02	19.64	2.21	14.70
Socioeconomic background				
Father's occupational status	35.52	19.15	35.17	19.48
Father's post-secondary qualification (%)	16.23	36.88	31.72	46.55
Mother's post-secondary qualification (%)	9.02	28.65	24.59	43.07
Number of siblings	2.80	1.96	2.30	1.47
Wealth	4.53	1.00	4.94	1.22
Schooling origins				
Catholic schools (%)	15.89	36.57	20.04	40.04
Other independent schools (%)	7.82	26.85	10.59	30.78
Schools in non-metropolitan areas (%)	38.86	48.75	32.54	46.87
ACT (%)	1.38	11.65	1.87	13.54
Victoria (%)	28.41	45.11	26.23	44.00
Queensland (%)	14.27	34.98	15.46	36.17
South Australia (%)	10.41	30.55	9.47	29.29
Western Australia (%)	8.26	27.53	9.59	29.46
Tasmania (%)	3.22	17.66	3.78	19.08
Northern Territory (%)	0.13	3.57	0.79	8.86
Educational level (years)	12.07	0.99	12.35	0.93
Completion of year 12 (%)	47.97	49.97	62.90	48.32
Sample size	*2 772*		*1 713*	

Table 3.2 Weighted Means and Standard Deviations of Variables—Males

	1961 COHORT		1970 COHORT	
Variable	***Mean***	***Std.Dev***	***Mean***	***Std.Dev***
Personal characteristics				
Individual ability	57.21	7.46	53.15	7.43
Non-English speaking parents (%)	17.84	38.30	20.94	40.71
Youth born in non-English speaking country (%)	4.76	21.29	1.45	11.95
Socioeconomic background				
Father's occupational status	36.33	19.42	35.19	19.62
Father's post-secondary qualification (%)	16.39	37.03	32.69	46.94
Mother's post-secondary qualification (%)	7.88	26.95	23.36	42.34
Number of children	2.87	2.09	2.41	1.50
Wealth	4.55	1.03	4.92	1.22
Schooling origins				
Catholic schools (%)	18.77	39.06	19.45	39.60
Other independent schools (%)	8.24	27.51	11.10	31.43
Schools in non-metropolitan areas (%)	39.98	49.00	33.94	47.38
ACT (%)	1.31	11.38	1.42	11.84
Victoria (%)	29.67	45.70	23.54	42.45
Queensland (%)	14.46	35.19	17.97	38.42
South Australia (%)	10.81	31.06	9.23	28.97
Western Australia (%)	7.60	26.51	9.76	29.69
Tasmania (%)	3.20	17.62	3.77	19.07
Northern Territory (%)	0.11	3.26	0.73	8.51
Educational level (years)	12.05	0.99	12.28	0.97
Completion of year 12 (%)	46.33	49.88	59.76	49.07
Sample size	*1 340*		*788*	

Table 3.3 Weighted Means and Standard Deviations of Variables—Females

	1961 COHORT		1970 COHORT	
Variable	***Mean***	***Std.Dev***	***Mean***	***Std.Dev***
Personal characteristics				
Individual ability	57.15	6.69	54.08	6.97
Non-English speaking parents (%)	17.68	38.17	22.36	41.69
Youth born in non-English speaking country (%)	3.28	17.81	2.88	16.74
Socioeconomic background				
Father's occupational status	34.71	18.85	35.15	19.37
Father's post-secondary qualification (%)	16.08	36.75	30.87	46.22
Mother's post-secondary qualification (%)	10.16	30.23	25.67	43.71
Number of children	2.73	1.91	2.21	1.43
Wealth	4.52	0.97	4.97	1.21
Schooling origins				
Catholic schools (%)	13.02	33.66	20.56	40.34
Other independent schools (%)	7.40	26.18	10.14	30.20
Schools in non-metropolitan areas (%)	37.75	48.49	31.31	46.40
ACT (%)	1.44	11.92	2.26	14.87
Victoria (%)	27.14	44.49	28.60	45.21
Queensland (%)	14.07	34.78	13.25	33.92
South Australia (%)	10.02	30.03	9.68	29.59
Western Australia (%)	8.91	28.50	9.45	29.27
Tasmania (%)	3.24	17.70	3.79	19.10
Northern Territory (%)	0.15	3.85	0.85	9.12
Educational level (years)	12.10	1.00	12.41	0.88
Completion of year 12 (%)	49.61	50.02	65.68	47.51
Sample size	*1 432*		*925*	

Appendix 4: Decomposition of Schooling Attainments Based on Logit Models

The Blinder (1973) decomposition was developed for models estimated using least squares procedures, and utilises the computational property of this estimator that the sample regression line passes through the sample means. With non-separable models like the logit model, the decomposition of actual differences in schooling attainments (e.g., differences in the probability of completing year 12) cannot be conducted in the same exact manner as with equations estimated by linear least squares. However, a decomposition method for the logit model analogous to Blinder's method has been proposed by Farber (1990). Under Farber's procedure, the aim is to decompose the difference in the average predicted probability of the event under consideration into a component that is attributable to the different characteristics of the groups being compared, and a part that is to be viewed as the impact of either a characteristic that has been used to partition the sample (e.g., gender for cross-sectional analyses) or time (for cohort analyses). For the purpose of this decomposition, the average predicted probability for group *i* is defined as:

$$P(X_i\beta_i) = \frac{\sum_{j=1}^{n} F(X_{ij}\beta_{ij})}{n} \qquad (4.1)$$

where P( ) is the average predicted probability, and F( ) is the cumulative distribution function for the logit model.

Farber proposed categorising the difference in the average predicted probability between two groups, 'a' and 'b', into two parts as follows:

$$P(X_a\beta_a) - P(X_b\beta_b) = [P(X_a\beta_b) - P(X_b\beta_b)] + [P(X_a\beta_a) - P(X_a\beta_b)] \qquad (4.2)$$

Similar to the way in which Blinder's decomposition is interpreted, the first term on the right-hand side of the above equation is the part of the difference in schooling attainments that is due to differences in the values of the measured attributes used in the models to account for educational attainments. It shows the difference in educational attainments that would arise in a situation where both groups' characteristics were linked to education attainment in the same way. The second term on the right hand side is the unexplained component of the difference in educational attainments. This is the part of the difference in educational attainments that is generally interpreted as an effect due to a specific characteristic used to partition the sample (e.g., gender) or a cohort effect.

The decomposition proposed by Farber may be extended to address comparative rates of change over time in school participation rates of males and females in a manner analogous to the Wellington (1993) decomposition. In this case the differential in changes in the year 12 completion rates of males and females between two time periods, 1970 and 1960, can be categorised as follows:

$$[\{P(X_m^{70}\beta_m^{70}) - P(X_m^{61}\beta_m^{61})\} - \{P(X_f^{70}\beta_f^{70}) - P(X_f^{61}\beta_f^{61})\}] =$$

$$[\{P(X_m^{70}\beta_m^{70}) - P(X_m^{61}\beta_m^{70})\} - \{P(X_f^{70}\beta_m^{70}) - P(X_f^{61}\beta_m^{70})\}] +$$

$$[\{P(X_f^{61}\beta_m^{70}) - P(X_f^{61}\beta_m^{61})\} - \{P(X_f^{61}\beta_f^{70}) - P(X_f^{61}\beta_f^{61})\}] + \qquad (4.3)$$

The left-hand term in the above equation records the difference in the changes in the year 12 completion rates of males and females between 1970 and 1961. A positive value for this term would indicate that male year 12 completion rates have increased by more than female year 12 completion rates. The first term in square brackets on the right-hand side of the above equation is the part of the difference in the growth in year 12 completion rates between males and females that is primarily attributable to different rates of change for males and females in the values of the characteristics used to explain schooling attainment. It corresponds to the 'explained' component in the Wellington (1993) decomposition. The second term in square brackets on the right-hand side of the equation is the part of the difference in the growth in year 12 completion rates of males and females that is primarily attributable to different magnitudes of the changes in the coefficients in the models of educational attainment estimated for males and females. It corresponds to the 'unexplained' component in the Wellington (1993) decomposition.

The sample weights described in the text are used when undertaking the calculations outlined in equations 4.2 and 4.3.

Appendix 5: The Return to Education and School Continuation Decisions

An issue addressed in the text is that even though a factor may affect female labour market outcomes and not those of males, it need not have a differential impact on the school continuation decisions of males and females. Appendix 5 explores this matter.

Consider a case where school leaving decisions were made largely according to the human capital model. Thus the crucial factor determining these decisions is the rate of return associated with the incremental level of schooling. For the decision to continue into year 12 from year 11, this return will be calculated by solving $\sum_{t=1}^{T}\left(\frac{Y_t^{12} - Y_t^{11} - A_t}{(1+r)^t}\right) = 0$ where Y_t^{12} is the earnings with year 12 education in year t, Y_t^{11} is the earnings with year 11 education in year t (which is the opportunity cost of the year 12 education), A_t denotes the direct costs of education, r is the internal rate of return and T is the number of years the individual receives rewards in the labour market. Assume that A_t is small relative to the earnings streams and so it can, for the purpose of illustration, be set equal to zero. Then the marginal internal rate of return for year 12 education is found by solving $\sum_{t=1}^{T}\left(\frac{Y_t^{12} - Y_t^{11}}{(1+r)^t}\right) = 0$.

Now assume that female earnings (or net labour market rewards) increase relative to those of males. If earnings for female year 12 leavers and for year 11 female leavers increase by the same proportion 'g', then the marginal return to year 12 education is found by solving $\sum_{t=1}^{T}\left(\frac{Y_t^{12}(1+g) - Y_t^{11}(1+g)}{(1+r)^t}\right) = 0$ for r. This may be expressed as $\sum_{t=1}^{T}\frac{(Y_t^{12} - Y_t^{11})(1+g)}{(1+r)^t} = 0$. Obviously, the same value of r will solve this as would solve $\sum_{t=1}^{T}\left(\frac{Y_t^{12} - Y_t^{11}}{(1+r)^t}\right) = 0$. In other words, because female education decisions are made, in the human capital framework at least, by comparing the advantages for females at a higher level of education with the situation for females at a lower level of education, factors that have the same proportional effect on females at all levels of education will not have any influence on the school leaving decisions.

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